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March, 1935

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IN THIS ISSUE—Articles on Operating an Air Conditioning System • Revamping an Old Heating System • Welding Piping for High Pressure–High Temperature Steam • Diffusion of Conditioned Air • Water in Compressed Air Piping • Reducing Cost of Heat • and others. Also the Journal Section of the American Society of Heating and Ventilating Engineers. . . . . .

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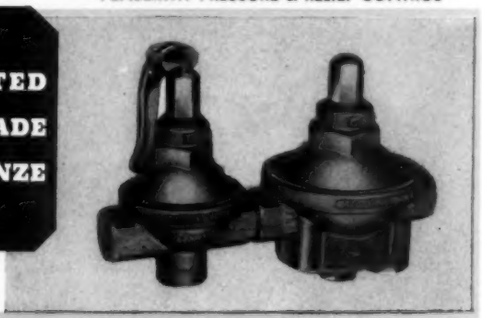

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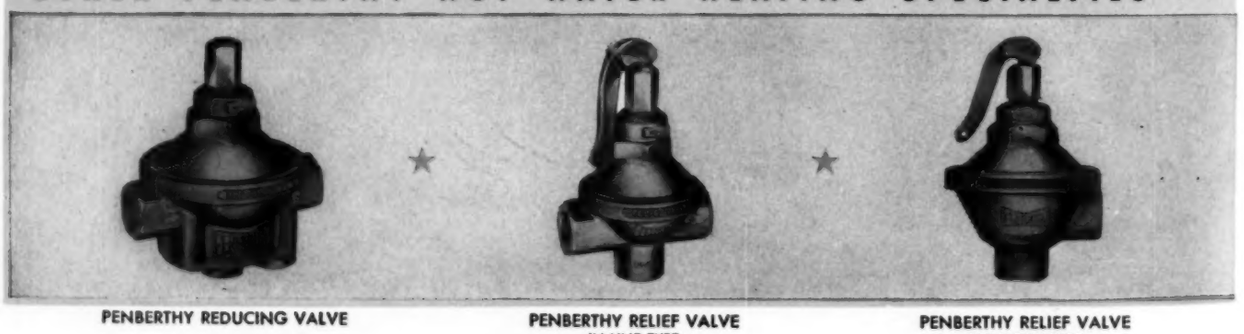

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THE certified **air conditioning standards** mentioned in an item last month have since been published in an eight page bulletin under the copyright of the Chicago Master Steamfitters' Association. . . The committee that developed the standards comprised H. M. Hart and Chas. E. Crone Jr., of the Association; Edw. P. Rich and Chester L. Post of the consulting engineers' division of the Western Society of Engineers; and Wm. C. Ashley and R. B. Hayward of the Ventilating and Air Conditioning Contractors' Association. Samuel R. Lewis, chairman of the consulting engineers' division of the W.S.E., acted as secretary and chairman of the standards committee. . . The standards cover definitions and guarantees; design coefficients and temperatures; infiltration and leakage values, etc.; heat gain from the sun; design air quantity; recirculation; diffusion of entering air; refrigerating apparatus and refrigerants; metals for housings, tanks, ducts, etc.; heat transfer apparatus; noise control; and insulation.

PROF. VERN O. KNUDSEN of the University of California at Los Angeles was recently awarded the $1,000 annual prize of the American Association for the Advancement of Science in recognition of his paper presenting a report of his work in sound absorption. . . Doctor Knudsen is known to readers of H.P.&A.C. through his articles on **sound control in air conditioning** which have appeared in past issues.

THE United States Bureau of the Census final report on stoker sales for 1934, recently released, shows that sales by 83 **stoker** manufacturers for the last year totaled 21,253 units as compared to 14,810 in 1933 and only 9,571 in 1932. This is an increase of 6,443 units or 43½ per cent over 1933. 78 per cent of the total 21,253 sales or 16,513 units were machines having a capacity of 100 pounds of coal feed per hour and less.

THE college of engineering of the University of Illinois is offering another short course in **coal utilization** at Urbana, June 11-13, under the auspices of the departments of mining and metallurgical, and mechanical engineering. . . Registration at last year's course was 146. The committee in charge comprises A. C. Callen, O. A. Leutwiler, D. R. Mitchell, and A. P. Kratz. . . A course in **warm air heating** sponsored by the National Warm Air Heating and Air Conditioning Association will be held at Michigan State College, East Lansing, March 27-29. . . Prof. L. G. Miller of the department of mechanical engineering is in charge. . . Approval of the Engineers' Council for Professional Development as the agency for **accrediting engineering colleges** was conferred by the American Institute of Electrical Engineers last month, completing the authorizations needed to inaugurate the accrediting procedure. . . Principles and procedures for the accrediting have been announced by the E. C. P. D.

NEARLY two-thirds of the retail stores in the U. S. are in need of **modernization** according to the Federal Housing Administration. . . The FHA estimates that a billion dollars could well be spent on the 967,000 outmoded buildings among the million and a half stores in operation. . . Air conditioning to attract and hold customers, heating systems which operate economically, would seem to be among the most important considerations in modernizing such establishments.

DOES the ——— ——— Company make a thermostat and a humidistat?" "What is their address?" "Who makes pipe covering?" . . A reader phoned us the other afternoon to ask for the above information. We gave it to him—gladly—, suggested he could have found the answers in his copy of the January, 1935, H. P. & A. C. in which was published the air conditioning directory section. "I know it," he said, "but some one stole it. You ought to tell your readers to keep their January issues **in their desks**—not on them."

A SURVEY of 26 public utility companies reports 1,993 air conditioning installations in a territory of 20 million population, according to the "Index" of the New York Trust Company. . . Of these installations 269 were industrial; 1,220 were commercial and 504 domestic. Air conditioned railroad cars total 2,478, approximately half owned by the Pullman Company.

ADVANTAGES of industrial air conditioning were pointed out by W. H. Carrier in addressing a group of physicists recently. In general air conditioning for process pays for itself in two years, he said. . . In one application, air conditioning gets the credit for a 20 per cent increase in the strength of **yarn for tire fabric.** A pottery works doubled plant capacity by speeding up drying, reduced spoilage to less than one-half, by air conditioning. . . As to comfort air conditioning, an early installation in a 2,000 seat theater which cost $65,000 **paid for itself** in three months. . . Mr. Carrier states also that railway air conditioning has almost forced the hotel people to consider air conditioning; stepping from a cool train does not make a hot hotel room a very attractive proposition.

IN a recent address John Howatt, president of the American Society of Heating and Ventilating Engineers, classified air conditioning as follows: (1) air conditioning for industrial processing; (2) air conditioning for comfort; and (3) air conditioning for health. The first is the oldest application of air conditioning, and is finding new uses every day, he said. Air conditioning for comfort—including of course, air conditioning for profit in offices, theaters, stores, restaurants and other commercial establishments—is receiving the most attention today. The third classification—air conditioning for health—will over-shadow the others in importance in the future, according to Mr. Howatt, as it involves human life and well-being to a very great extent. . . There is much research to be done in the field of air conditioning for health, and an ever-growing interest in determining the fundamentals of this field of air conditioning. The A. S. H. V. E. has recently completed arrangements with the Mayo Clinic of Rochester for at least three years of work on the subject, and much is expected from this cooperative effort.

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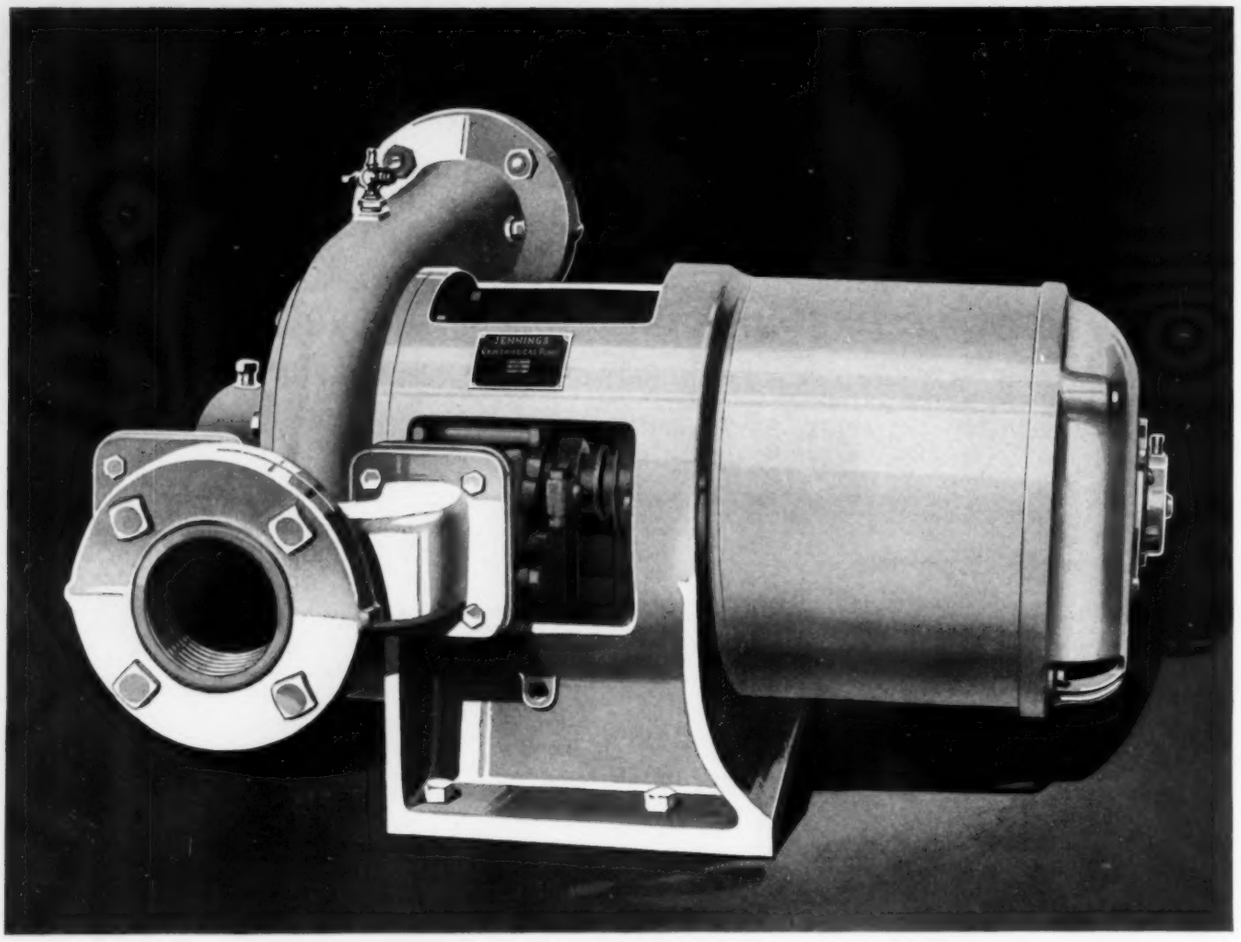

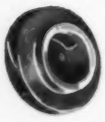

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Heating·Piping and Air Conditioning

March, 1935 • *Vol. 7, No. 3*

Operation and Maintenance of Plant Air Conditioning System to Avoid Service Interruption

By W. C. Giles*

Continuous operation of the air conditioning equipment required in many plants makes maintenance of the system a problem to be given particular attention .... The author gives here the maintenance pointers he has found valuable in aiding uninterrupted air conditioning service

AIR CONDITIONING equipment serving an industry operating continuously must of necessity be installed and operated so as to preclude as far as possible any interruption due to equipment or apparatus failure. Because of the space required by and the cost of an air conditioning system, duplication of the equipment to provide standby service is difficult to justify from an economical standpoint.

In the rayon industry—as an example—a large part of the air conditioning equipment is operated continuously, calling for particular attention from a maintenance standpoint.

Dirt in Circulating Water a Problem

In the operation of central station air conditioning systems, probably the greatest difficulty encountered is from dirt accumulating in the circulating water of the humidifier which tends to block spray heads and screens. Dirt in the circulating water comes from the air passing through the equipment and also from products of corrosion.

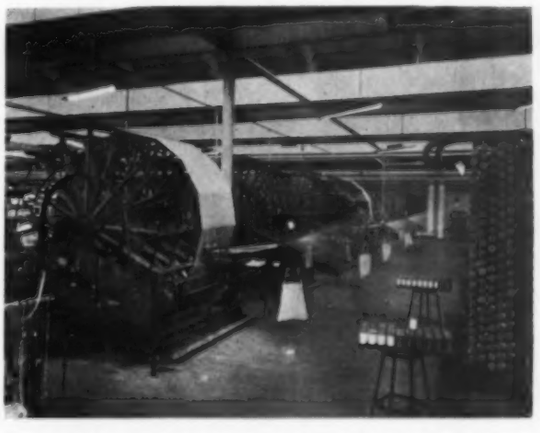
Where humidifiers are operated continuously, replacing clogged spray heads is a problem as changing individual heads requires considerable time. This difficulty partially can be overcome by having available at all times a complete set of spray *headers* with spray heads installed. Replacing headers requires practically a negligible amount of time compared to changing individual spray heads. Changing headers also insures clean headers as well as clean spray heads, while changing individual heads may result in a head becoming clogged shortly after being installed due to dirt in the header.

The sockets into which the headers are installed should be extra heavy to compensate for the number of times headers may be screwed in and out of them. Immediately on removing spray headers, the heads should be cleaned or replaced and the headers thoroughly cleaned to remove any scale or dirt in order that they may be available for future use.

Corrosion of Humidifiers

The corrosion of humidifiers offers quite a problem, as so much of the equipment is constantly in contact with the water spray or the dampness from the spray. Very beneficial results can be obtained by keeping the surfaces in contact with this dampness coated with corrosion resistant paint, which should be applied at regular intervals.

*The Viscose Company, Marcus Hook, Pa.



Rayon plants need uninterrupted air conditioning service

A large amount of corrosion in humidifier equipment can come from the circulating water becoming slightly acid. Therefore, the pH value of the circulating water should be checked each day and in locations where the air supply is poor due to local conditions, a check should be made oftener than this. When the circulating water shows signs of acidity, chemicals should be added to keep the water slightly alkaline, which will materially reduce corrosion.

Where possible, the circulating water should be changed weekly, all sediment washed out, and a check made of the pH of the fresh water.

In plants where it is essential that humidity be furnished continuously, steam sprays can be installed for the introduction of live steam to supply this humidity while the circulating pump is shut down for minor repairs, such as packing glands, etc. Steam sprays also can be used as auxiliaries at such times as a very high humidity is required.

Periodic inspections of fan blades and stay rods should be made, as corrosion may take place during long periods of continuous operation, causing the blades or stay rods to become loose and tending to throw the fan out of balance and cause serious damage.

All equipment should be checked over during the spring for necessary repairs and again during the late summer before heat is required, as the sheet metal work deteriorates much more rapidly after the heat is shut off. To maintain high humidities during the spring and summer it may be necessary to use live steam in the humidifier, which keeps the equipment wet and causes corrosion to take place rapidly.

Painting of humidifiers should be done in so far as possible in the summer when heat is off the apparatus while dehumidifiers can be painted to better advantage during the winter when outside air can be used.

While humidifiers are normally made of sheet metal, there is often a decided advantage—where possible—in having the pan for circulating water constructed of concrete. Metal pans, even with protective coatings, must be replaced due to corrosion after a certain length of time.

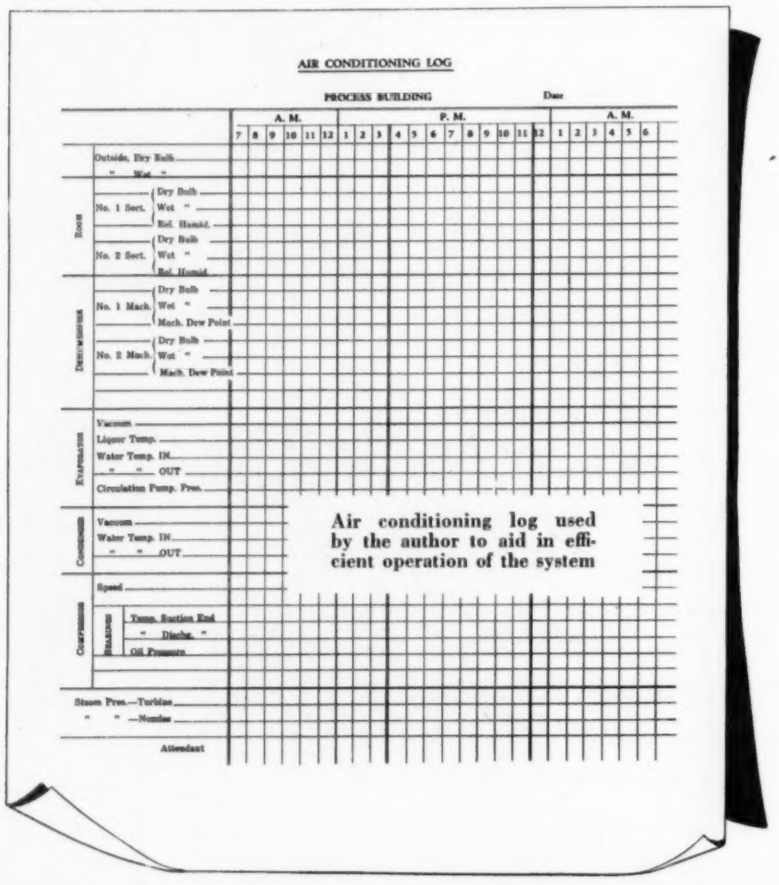
Maintenance of Condensers Important

The refrigerating equipment does not offer as serious a maintenance problem as some other parts of the air conditioning equipment, for in most localities there is no load or at least a light load during the winter months. At this time, the necessary repairs and complete inspection can be made.

Consideration should be given to the selection of the proper type of refrigeration condensers. Where water conditions require the frequent cleaning of condensers the small shell-and-tube type condensers installed in groups work out very satisfactorily. This type of condenser allows a unit to be taken out of service for cleaning without materially reducing the total condenser capacity. Clean condensers pay dividends in operating refrigerating equipment, as lower head pressures are directly reflected in the power required per ton of refrigeration.

Checking Maintained Conditions

The control apparatus for the air conditioning system must be checked and calibrated at regular intervals if the desired conditions are to be maintained. Where temperature and humidity conditions must be maintained within very close limits, regular checks must be made at short intervals. Ordinarily these checks are made at hourly intervals; however, when some difficulty is encountered with the equipment or when building conditions are being changed, checks may have to be made at much shorter intervals, until the desired condition is obtained. The log sheet shown provides for the recording of conditions maintained as well as a record of the performance of the equipment and very often is valuable for later reference.


AIR CONDITIONING LOG

PROCESS BUILDING Date

A. M. 7 8 9 10 11 12 — P. M. 1 2 3 4 5 6 7 8 9 10 11 12 — A. M. 1 2 3 4 5 6

Outside, Dry Bulb
" Wet "

Room: No. 1 Sect. (Dry Bulb, Wet ", Rel. Humid.); No. 2 Sect. (Dry Bulb, Wet ", Rel. Humid.)

Dehumidifier: No. 1 Mach. (Dry Bulb, Wet ", Mach. Dew Point); No. 2 Mach. (Dry Bulb, Wet ", Mach. Dew Point)

Evaporator: Vacuum; Liquor Temp.; Water Temp. IN; " " OUT; Circulation Pump. Pres.

Condenser: Vacuum; Water Temp. IN; " " OUT

Compressor: Speed; Bearings (Temp. Suction End, " Discha. "); Oil Pressure

Steam Pres.—Turbine; " " —Nozzles

Attendant

Air conditioning log used by the author to aid in efficient operation of the system

Revamping

a Twenty-Year-Old Heating System

By **George T. Condron***

Church properties present many heating problems, offer numerous opportunities for improving heating service. This article describes the revamping of a 20-year old system in a church property comprising three buildings — the church, rectory, and parish house. The changes made suggest the possibilities in modernizing church heating systems

LAST fall, the vestry of St. Paul's Episcopal Church, Springfield, Ill., was faced with the necessity of overhauling the heating plant serving the church property because of the worn-out condition of the boilers and some of the piping. It was desired to effect certain improvements at the same time, if possible.

The property consists of three buildings: the church, the parish house and the rectory. The church and parish house are adjoining and form what is virtually one L-shaped building; the rectory is separated from the other two buildings and is served through underground supply and return mains about 25 ft long.

The Old Heating System

The existing heating system, of the vacuum type, had been installed when the buildings were built over 20 years ago and the layout was as shown schematically in Fig. 1. Steam was supplied from the two brick-set low pressure boilers located in the parish house and the entire system was served by one gear vacuum pump situated in the boiler room. All mains were graded to drips at the far ends, except the main to the rectory which had an additional drip at the point where it entered the building. Each of the three steam supply mains had a manual shut-off valve in the boiler room, these valves being the only sectionalizing control. The boilers were fired by hand, using local coal.

In addition to replacing worn-out equipment, the following improvements were desired, finances permitting:

1. To reduce the noise resulting from water hammer.
2. To make provision for shutting off certain parts of the parish house when not in use.
3. To provide better service to the rectory, especially at night.

A survey of the system showed the boilers, virtually all of the traps, and the vacuum pump to be in such condition as to require replacement. The piping was all found to have ample and consistent pitch, but a good part of it was at least one pipe size under present recognized practice.

The most serious difficulty with the piping was in the method of dripping the steam mains. The piping at these points was arranged as shown in Fig. 2. The return main was located above the supply main in every case and the lifts from the low point on the trap discharges to the return mains averaged about 24 in. No form of lift fitting had been employed at any of these points.

With this arrangement it is probable that the ends of the mains had never been satisfactorily drained, and with the worn-out condition of the old vacuum pump it was

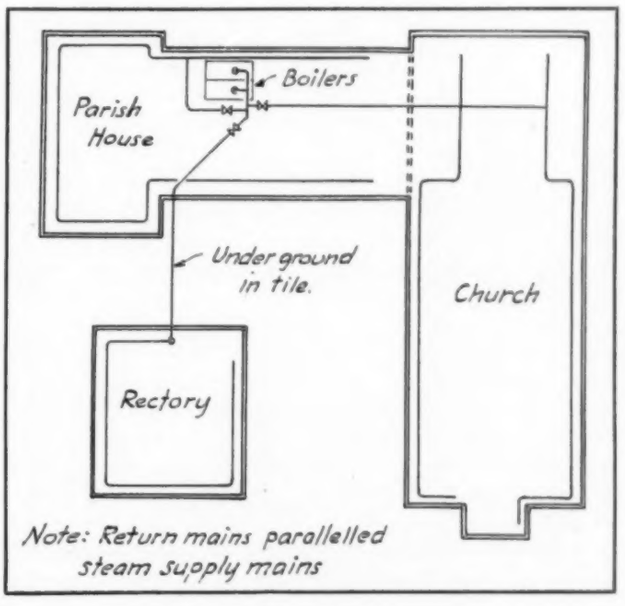


Fig. 1—Schematic diagram of the steam piping system

*Mechanical Engineer.

probable that a considerable length of the steam main remained virtually full of water at all times.

The following work was contemplated in the solicitation of proposals because it was felt that it gave the greatest benefits for the money expended:

1. Install one new boiler having a rated capacity about 25 per cent in excess of the total connected radiation.
2. Install stoker for firing the new boiler.
3. Install new return piping from the steam main drips so as to avoid any lift.
4. Install one new vacuum pump in the boiler room to serve the church and parish house only.
5. Install a second new vacuum pump in the rectory so as to avoid the necessity of lifting the condensate and to make this system self-contained as far as possible.
6. Install new traps on all radiation and steam main drips.
7. Install motor-operated valve on steam main serving rectory and room thermostat for automatic control.
8. Install new radiator steam supply valves, or service old valves, so as to be able to shut off radiators when heat is not required—especially in the parish house.
9. Cover all steam mains.

After the proposals were opened it was found that the money available would not cover Items 8 and 9.

The System as Rebuilt

The rebuilt system does not have as much reserve boiler capacity as the original system had, and has no spare boiler, but under the operating conditions the capacity has proved ample. The stoker has helped in this, since it is possible to have steam available all night and thus lengthen the heating period. This constant supply of steam also makes it possible to heat the rectory at night after the steam pressure would be down if the fire had been banked, as in hand firing. The stoker was really installed for the better service it could provide since the annual cost of coal was too low for any probable savings to amount to a considerable sum.

With the new return piping from the steam main drips providing gravity return to the vacuum pump receiver, the steam circulation was materially improved, especially at the ends of the mains. The annoyance from water hammer was materially reduced, and with the longer possible heating-up period, the steam velocities could be reduced enough (by controlling the initial rate of supply) to practically eliminate all hammer. The under-size piping makes it difficult to fill the radiators at the ends of the church mains, but they can be filled by shutting off some of the nearer radiators. Once these end radiators have been filled, all radiators can be supplied successfully.

With the stoker making steam always available, the thermostatic control, and the separate vacuum pump, the service to the rectory is very satisfactory. The first motor-operated valve installed in the rectory opened too rapidly, resulting in a sudden rush of steam and considerable hammering. This was remedied by retarding the rate of operation so as to provide a 3½ minute period from "fully closed" to "fully opened", thus reducing the initial surge.

Since the stoker control is of the pressure-vacuum type, it is possible to operate with sub-atmospheric pressure at the boiler. Thus, the rate of heating in the church and parish house can be reduced (even to zero) by setting the stoker control to maintain very low gage or even sub-atmospheric pressures at the boiler and cutting out the vacuum control on the church-parish house vacuum pump. Under these conditions the rectory can continue to be heated while the circulation in the larger systems is greatly reduced, but not necessarily completely stopped.

Since an additional main for sectionalizing the service to the parish house would have meant a virtual duplication of the existing supply main, the expense appeared to be out of proportion to the probable savings. However, with the radiator supply valves put in shape, it is possible to handle the matter very well.

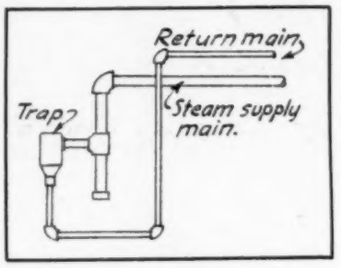


Fig. 2—Elevation of typical steam supply main drip as found on the old system. With the return main above the supply, no lift fitting, and the worn-out vacuum pump, it is probable that a considerable portion of the steam main was full of water most of the time

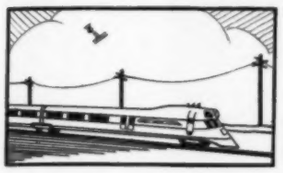
After the other work had progressed to a point where the piping system could be put under pressure, a test was made to locate any leaks. These generally occurred where the piping had corroded through. The needed new pipe was installed and the entire system made tight. Because it had been impossible to determine accurately the extent of this work in advance, it was not included in the lump sum proposal, but was paid for on a predetermined cost plus basis.

KINKS

"There's more than one way to skin a cat," says the old proverb, and in modernization and remodelling work, ingenuity in finding the best way may mean the difference between profit and loss.

For example, on a certain project it was desired to replace an old boiler with a new one. Removing the old boiler apparently meant cutting a hole in the building wall, although the newer boiler, of smaller size, could be installed without difficulty. The cost of opening the wall and removing the boiler was included in all the bids but one. The low bidder disposed of the old boiler in a simpler way. A hole was dug in the basement floor, the old boiler buried, the dirt—instead of the boiler—carried out of the basement.

A steel mill had difficulty in the winter time with its lubricant for roll-neck bearings, which congealed in the pipe lines. Formerly a steam pipe or air duct was nested with the pipe lines. Now soil heating cable has been wound around the pipes and insulation applied. A thermostat maintains temperature of the lubricant at the proper point, no matter what the weather.



Heating and Air Conditioning the Newest Stream-Liner

(Photo on front cover)

JUST a year ago, an illustration of the Union Pacific's first stream-lined train appeared on the cover of H. P. & A. C. and an article in that issue described the air conditioning and heating of the "M-10000", as it is known. Since that time, stream-lined trains and railway car air conditioning have been the subject of many a newspaper headline, have been the most talked about technical developments in the railway field. In addition to the air conditioned stream-liners, hundreds of conventional railway passenger cars have been equipped with air conditioning systems, announcements being made by the roads almost daily. The Santa Fe, for instance, plans to provide air conditioning for 280 additional passenger cars—175 standard sleepers, 25 tourist sleepers, and 80 railroad-owned cars consisting of chair cars, club cars, dining cars, lounge cars, etc. This road air conditioned 89 passenger cars for service during 1934, of which 30 were standard sleeping all-room cars, the other 59 being railroad-owned dining, lounge, and club cars. The Pennsylvania is air conditioning all through trains, is equipping 78 additional cars to bring the total of air conditioned cars owned by this road and assigned to it by the Pullman Company to 887.

As to stream-lined units (all of which are of course air conditioned) the newest of these is shown on this month's cover—the New Flying Yankee of the Boston and Maine Railroad and Maine Central Railroad, which made its demonstration runs last month. It is a three-section articulated unit powered by a 600 hp diesel electric engine, constructed of stainless steel by the shot weld process by the Edward G. Budd Mfg. Co.

Flying Yankee Air Conditioning System

Each of the five passenger compartments of the New Flying Yankee is air-conditioned, the compressors and condensers being housed beneath the floor of each unit, while the evaporators and the distributing fans are built into the roof above the vestibules. Fresh air is taken in through the doors into the vestibules and is then passed through filters where it is mixed with the recirculated air in the proportion of about 1:5. In the evaporator are located two combination cooling and heating coils—one at either side—and between these are two double blowers which project the conditioned air through centrally located grilles into opposite passenger compartments. The air is returned through grilles at either side of partitions at the roof. Here, too, are located removable and washable filter pads. Capacity of the refrigerating system is 5½ tons per car. In moderately cold weather the overhead coils heat the compartments without side wall radiation. The entire equipment for the train weighs approximately 4600 lb complete.

In order to reduce to a minimum heat losses as well as to prevent frost collecting on the windows during the low temperatures to be encountered in service, an unusual arrangement of double sash is used.

All side windows, with the exception of the doors and the curved sash in the lounge compartment, are glazed with double hermetically sealed units made up of two pieces of ¼ in. special shatterproof glass having ¼ in. dry air space between. In order to overcome the severe weathering, a special plastic sheeting is used, which is resistant to ultraviolet sun rays. The two pieces of glass are framed with a stainless steel band to protect the edges. Special attention was given to the re-glazing of the window sash, it being so designed that all this work can be done from the outside of the car.

The Heating System

The train is equipped with steam heat throughout, steam being provided by an oil-fired boiler with an evaporative capacity of 500 lb per hr at a pressure of 85 lb. This boiler is located at the front end of the baggage room in the first unit. Its operation is completely automatic once the boiler has been started, and is subject to three controls: (1) A water level control; (2) A low-water control, and (3) A burner load control.

Heat is supplied to the passenger compartments from two sources. A fin-tube coil in the evaporator unit of the air conditioning system in each compartment supplies heat to the fresh and recirculated air passing through the units to the compartments. Steam is also supplied to a copper fin-pipe along the truss plank near the floor on each side of the compartment. The admission of steam to both radiators is controlled by a separate regulator and a magnet valve—the latter being actuated by a thermostat. The regulator reduces the steam from 85 lb to atmospheric pressure, and no high pressure steam is used in the radiating pipes. A thermostat for the control of the air conditioner radiators is located on a deadlight panel near the center of each compartment about 5 ft above the floor. The thermostat for the sidewall radiators is placed near the floor and serves to bring these radiators into action automatically when the heat distribution from the air conditioning unit is not sufficient to maintain a predetermined temperature at the floor.

In order to reduce the weight of the water carried, the radiators in the second car drain into a small sump which is interconnected with the main boiler feed water tanks and is automatically controlled by a float valve. As a predetermined low water level in the sump tank is reached, the float valve admits water from the main tanks and always maintains a certain water level independent of the amount of condensation furnished by the radiators.

As the water level control in the boiler reaches the point where the feed pump is controlled, it automatically starts the pump and sends the water from the second car to the boiler in the first car.

During layover period, the entire train can be heated by steam from the terminal supply.

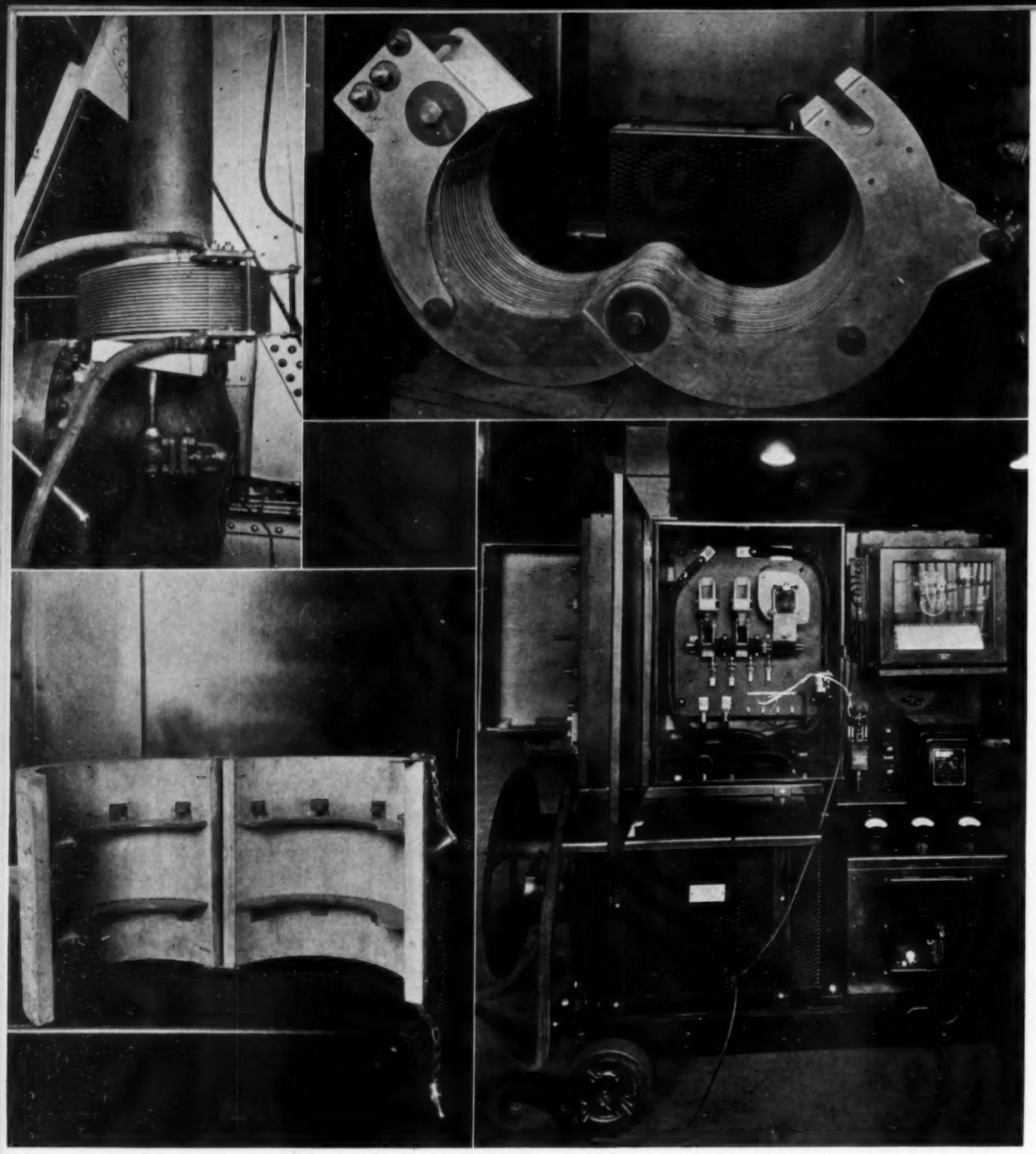


Fig. 1a (left above)—Stress relieving collar assembled and in operation on welded joint. Fig. 1b (right above)—Induction coil in the open position. Fig. 1c (left below)—Insulating shield for stress relieving collar. Fig. 1d (right below)—Transformer and control equipment, showing portability

Results obtained through welding high pressure, high temperature piping have been most encouraging and the problem has been interesting because the field is relatively new and each step in the development has led to another, says the author in concluding in this article his description of the details of the 600 lb—850 F steam piping for the Connors Creek plant. The electric induction heating device for stress relieving welds which was developed for this project is described, welding a flow nozzle into the line in such a manner as to avoid distortion of the nozzle is explained, as are the welding details for the small high pressure piping.

High Pressure—High Temperature Steam Piping Welding

By **Sabin Crocker***

WHEN the Connors Creek plant of The Detroit Edison Company was rebuilt for 600 lb, 850 F steam service, it was decided to solve the high pressure pipe joint problem by using strength welded joints. The objectives of the design, methods of welding and quality control of the welds, details of the large joints, and the backing rings and shape of the bevels used have been explained in a previous article.[1] The present article discusses the solution of other of the problems met in welding high pressure, high temperature piping.

Stress Relieving of Welds

In view of the prevailing belief that stress relieving is beneficial to electric fusion welds, experiments were undertaken to find out how this could be done to best advantage and in what way the treatment improved the weld. Through this investigation the electric induction heating device shown in Figs. 1a, b, c, and d was developed.[2] The winding itself (Fig. 1a) consists of several turns of an electrical conductor (Fig. 1b) clamped around the pipe directly over the weld, from which it is separated by a layer of heat insulation (Fig. 1c). The insulation serves both to hold the heat in the weld and adjacent pipe, and to keep the self-cooling conductor turns from either short circuiting or overheating.

The stress relieving collar is in the nature of a transformer in which the conductor turns comprise the primary circuit, and the weld and adjacent pipe wall a one-turn secondary short circuited on itself. When alternating current passes through the primary it induces a much heavier low voltage current in the one-turn secondary, thus developing heat where it is actually wanted. By providing an adjustable voltage current supply to the primary it is possible to bring the joint up to temperature quickly and then to cut down the current to hold any desired temperature for the required time, after which the current can be gradually decreased to give as slow cooling as may be wanted. A thermocouple tacked to the weld serves to indicate temperature and to actuate an automatic control circuit for holding any desired temperature. In this way the temperature at any one point may be maintained within 20 F of that desired. The maximum point-to-point variation of temperature in the weld resulting from variations in surface radiation, etc., has been found to be approximately 50 F for pipe diameter of 12 to 16 in., with lesser variations for smaller pipes. Beyond the heated area embracing the weld the temperature tapers off, of course, due to conduction through the pipe wall and radiation from the part outside the collar. The uniformity of temperature in the weld is so close and the tapering off outside so gradual as to preclude serious strains due to unequal heating and cooling.

The adjustable voltage current supply is obtained from a multiple-tap transformer which provides 25 voltage steps from minimum to maximum. In order to make the auxiliary equipment readily available to the location where welding is being done, the transformer, tap-changer, switches, and automatic control equipment are all mounted together on a hand truck (Fig. 1d) and equipped with long primary and secondary leads. This particular tap-changing transformer can be operated from any 230 volt, 60 cycle circuit of sufficient capacity, but there is no inherent reason why a similar transformer cannot be operated from almost any alternating current power circuit of proper size.

The present equipment has been used so far to stress relieve welds in pipes from 2½ in. to 16 in. diameter, the different pipe sizes being provided for by having several windings such as that shown in Fig. 1b, each of which is suitable for use on at least two pipe sizes. The collars are so compact that they can be used wherever there is sufficient clearance around the pipe to do a satisfactory welding job.

The purpose of stress relieving a weld in thick walled material, as the Company's engineers see it, is two-fold: *First,* to heat the affected portions of the structure to a temperature sufficiently high to allow any locked in stresses set up by the welding operation to relieve themselves through creep. This result probably could be accomplished at, say, a temperature of 900 F provided sufficient time were allowed at that temperature for creep to take place. The much quicker results obtained at 1100 to 1200 F, however, indicate that to be a more practicable temperature range. *Second,* to take advantage of the "drawing" or "tempering" action existing at 1100 to 1200 F commonly used in the heat treating of alloy steel castings and in the partial annealing of quenched or cold worked forgings. This draw has been found to increase the ductility of electrically deposited weld metal as much as 50 per cent in some instances, increase the impact strength in the order of

[1] "Welding High Pressure—High Temperature Steam Piping," by Sabin Crocker. HEATING, PIPING AND AIR CONDITIONING, February, 1935, pp. 81-84.

[2] "Stress Relieving Welded Pipe Joints," by A. P. Fugill and D. H. Corey, *Journal* of the *American Welding Society*, February, 1935.

* Engineer, The Detroit Edison Company, and Member of Board of Consulting and Contributing Editors.

10 to 15 per cent, and it probably has a favorable effect on the fatigue strength. The improvement in these properties is attributed to an equalization of the hardness characteristics of material throughout the weld obtained by the tempering process. In a metallurgical sense this improvement is obtained through converting the martensite and troostite structures, produced in the rapid cooling of weld metal from the liquid state, to sorbite. In establishing the stress relieving temperature at 1100 to 1200 F, the fact that the valve-body material was drawn at 1200 F was an important consideration since higher temperatures would have changed the physical properties of the cast material. Recent creep investigations on rolled carbon steel further indicated that heating for even a short period at temperatures of 1250 to 1300 F and higher might result in a material reduction in creep strength.

A commonly used rule for stress relieving welds is to hold the material within the temperature range of 1100 to 1200 F for a period of one hour per inch of wall thickness. It is believed further that reasonably slow cooling to about 600 F requiring one to three hours time is beneficial. Cooling of this sort is readily obtained with the electric induction collar annealer, since the current can be tapered off as gradually as may be desired.

The electrical energy required for stress relieving varies with the size of the pipe, but is low in any case. For example, stress relieving a weld in a 2½ in. pipe requires about 3 kw-hr; in an 8 in. pipe, 13 kw-hr; and in a 16 in. pipe, 22 kw-hr. While the cost of electricity required to stress relieve welded pipe joints is insignificant, labor cost plus carrying charges on the investment in equipment may represent a considerable item. The whole amount involved, however, represents but a small addition to the cost of high pressure piping.

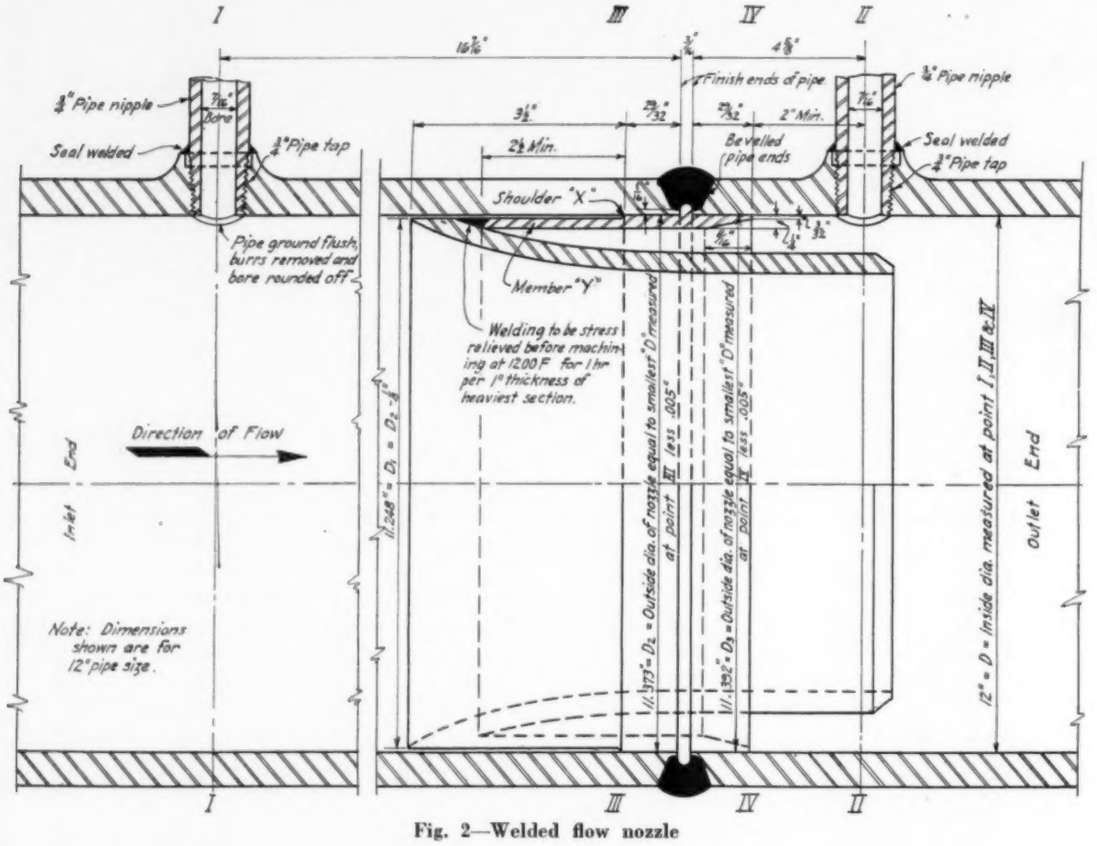

I
III
IV
II
16⅞"
¾"
4⅝"
¾" Pipe nipple
7/16" Bore
Seal welded
¾" Pipe tap
Finish ends of pipe
¾" Pipe nipple
3½"
2⅝"
2⅝"
2" Min.
2½ Min.
Beveled pipe ends
Seal welded
¾" Pipe tap
Shoulder "X"
Pipe ground flush, burrs removed and bore rounded off
Member "Y"
Welding to be stress relieved before machining at 1200 F for 1 hr per 1" thickness of heaviest section.
Direction of Flow
End
Inlet
Note: Dimensions shown are for 12" pipe size.
11.248" = D1 = D2 - A
11.373" = D2 = Outside dia. of nozzle equal to smallest "D" measured at point III less .005"
11.382" = D3 = Outside dia. of nozzle equal to smallest "D" measured at point IV less .005"
12" = D = Inside dia. measured at point I, II, III & IV
End
Outlet

Fig. 2—Welded flow nozzle

Installation of Flow Nozzles

How to install the flow nozzles was one of the interesting problems in changing over to all welded construction. The conventional place for a flow nozzle has been at a flanged joint where the flared rim of the nozzle could be clamped between the flanges. The welding of a flow nozzle into the line involved working out a design which would eliminate distortion of the carefully calibrated nozzle, or at least reduce any distortion to satisfactory limits.

With this end in view a design was evolved and a trial job of welding done with an actual flow nozzle. Careful measurements were taken with micrometers and the distortion found to be somewhat more than was deemed permissible. The design was then altered to that shown in Fig. 2 and another trial made, this time with satisfactory results. The change consisted in providing sufficient clearance for expansion from the shoulder marked "X" to the entrance of the nozzle, and in making the member "Y" sufficiently flexible to avoid distortion during the welding and stress relieving operations.

Details of the Small Joints

In working out an all-welded high pressure piping system, equally satisfactory details were desired for small pipes as for large. It was felt, however, that with the thinner wall sections of small pipes (which range from ½ to 2 in. diameter) there was no occasion to stress relieve the welds. This left for the major problem how best to substitute socket or fillet welds for the butt welds with backing rings used with larger pipes. Plain butt welds were ruled out for most locations because of the impossibility of removing weld splatter from the inside of pipes too small for backing rings.

A variety of cases existed, each of which required more or less special treatment. Among these were pipe-to-pipe line welds, pipe-to-fitting or pipe-to-valve welds, and the attachment of small pipes to large pipes or valve bodies for instrument connections, bypasses, drips, etc. Practically all of these started out as threaded connections seal-welded for tightness of the type shown in Fig. 2, but they shortly evolved into full-strength socket welds. Typical connections of this sort were shown incidentally in the view of the main steam cross-over reproduced with the previous article, and in greater variety in Fig. 3.

The change-over came about through a series of practical demonstrations of the efficacy of socket welded construction for small lines. Using one or two beads it was possible to make fillet welds as strong or stronger than the parts joined. The high efficiency of small socket welded joints is due in part to the fact that the weld is made on a substantially larger circle than if the same parts were joined by a butt weld, thus providing considerably more weld metal to take a given load. The

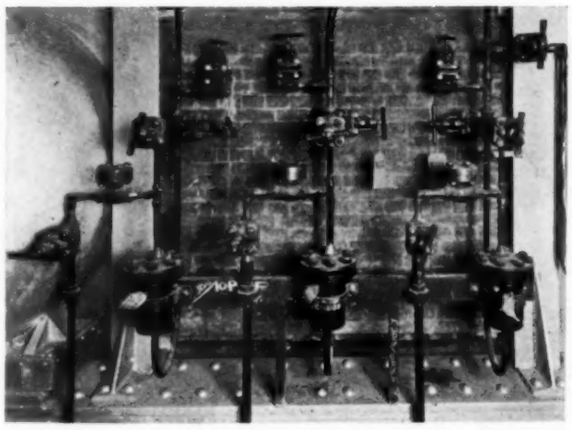


Fig. 3—Socket welded drip piping assembly

different types of socket connections are explained below in more detail.

Welded Sleeve Coupling—The welded sleeve coupling for small pipes shown in Fig. 4 is a logical development from the threaded coupling, and serves essentially the same purpose. It also makes feasible the omission of most of the unions commonly used with threaded contruction, as evidenced by the absence of unions in the high pressure piping of Fig. 3. All unions shown in this view are on the low pressure side of the traps. With welded construction most of the connections are merely welded up solid in the knowledge that, if the line must be taken apart, it can be cut in two with a hack saw and remade with a welded coupling. The necessity for making two fillet welds with such sleeves in place of a single butt weld is of course obvious, but

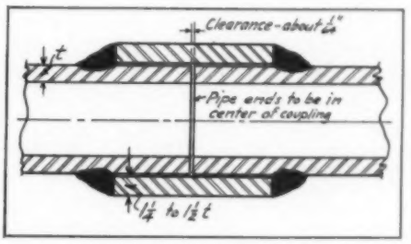


Fig. 4—Welded sleeve coupling

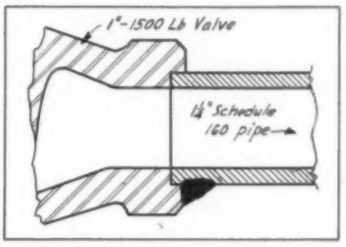


Fig. 5—Socket detail for small welding-end valves

this kind of work goes together fast and the ability to avoid weld splatter is worth the extra weld.

For high joint efficiency with a fillet weld the wall thickness of the sleeve or socket should be somewhat greater than that of the inserted pipe. Taking this into consideration as well as the fact that good welding is facilitated when the parts joined are of somewhere near equal thickness, it works out that the coupling should be about 1¼ to 1½ times as thick as the pipe, and preferably of the same material.

For the service conditions obtaining at the Connors Creek plant the couplings usually can be made to advantage of double-extra-strong pipe two nominal sizes larger than the line, and drilled out to give about 1/32 in. clearance on the diameter over the nominal outside diameter of the line. A gap of at least 1/64 in. should be left between the pipe ends inside the coupling to allow for expansion during welding.

Small Valves—Small valves such as those shown in Fig. 3 can be adapted conveniently from threaded valve designs by drilling the ends for sockets instead of tapping with the usual threads. The outside of the hexagonal ends should be turned down as shown in Fig. 5 to give a spigot having a thickness at its outer end about 1¼ times that of the pipe. Experience has shown that the seating parts of such valves are not heated sufficiently during welding to cause distortion or warping, and the results have been highly satisfactory.

Socket Fittings—A large number of socket welding tees and elbows were used in the small-size high pressure drip and instrument lines, as illustrated by the trap installation of Fig. 3. Cross sectional views of

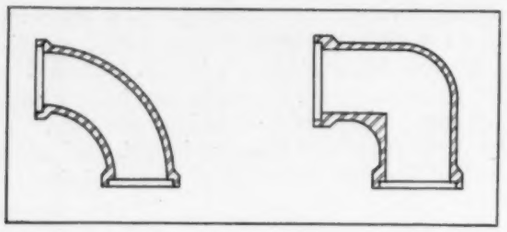


Fig. 6—Socket welding elbows. Sizes 2 in. and larger (left) are seamless; 1½ in. and smaller (right) are forged solid and machined out

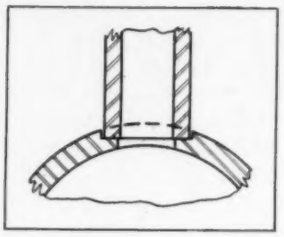


Fig. 7—Socket detail for welding small pipes to large

such fittings of the elbow type are shown in Fig. 6. The relatively shallow sockets were found advantageous rather than otherwise, and fully accomplished the purpose of preventing weld splatter.

Attachment of Small Pipes to Large Pipes or Castings—Past practice in the case of valve bypasses, cast manifold drips and the like has been to provide integrally cast pads which were drilled and tapped if required for the attachment of threaded pipes, usually ranging in size from ¾ in. to 1½ in. Where small pipes of this sort were to be attached to large wrought pipes it formerly was customary to build up welded pads to supplement the pipe wall thickness and then drill and tap the combined structure.

A transition stage was passed through in switching to all-welded construction. The intermediate step consisted in drilling and tapping the boss deep enough to have the threaded end of the small pipe entirely countersunk into the pad, and then seal welding to the boss the pipe wall just beyond the threads as shown in connection with the flow nozzle of Fig. 2. The next and probably ultimate step was to omit both the threads and the built-up welded boss on wrought pipe and merely drill, spot face, and slightly counterbore the wall to provide a socket into which the small pipe was inserted and fillet welded. A typical detail of this method of attachment is shown in Fig. 7. A similar procedure is now followed in the attachment of small pipes to castings, where the pads are drilled and then counterbored to make a socket for fillet welding. Several instrument and drip connections of this sort were shown in the view of the main steam cross-over reproduced last month, the external appearance being much the same whether the threads are omitted or present.

Conclusion

The results obtained through the adoption of welded construction for high pressure, high temperature piping have been most encouraging. The incentive for using welding is decidedly greater here than with low pressure piping. The problem has been interesting in that the field is relatively new and each step in the development has led to another. Flanged joints, and for that matter screwed joints as well, have been eliminated from the 850 F piping except for valve bonnets and where the steam lines are attached to the boilers and turbines. Probably a satisfactory substitute for flanges will be worked out eventually for these locations, too. Another possibility is the further application of welding to the fabrication of pipe hangers so as to eliminate cumbersome and expensive clamps through the substitution of simple clips welded directly to the pipe wall.

The application of welding to boiler feed lines was not so extensive as with superheated steam lines since the temperature was not high enough to cause creep in bolted flanges, and the close grouping together of numerous valves and fittings at bypasses and cross-covers did not lend itself so readily to welded construction. Welding was used, however, where there was any considerable run of pipe between valve nests.

Air Conditioning in St. Louis

THE number of air conditioning installations and the kilowatt load they represent in St. Louis, Mo., are summarized in the table, classified into those installations in service prior to 1933, those made in 1933, installations made during 1934, and the total as of December 31, 1934. It will be noted that of the 321 jobs in service at the end of 1934, 150 or about 47 per cent were installed during that year and that the 1934 jobs represent 1,020.46 or approximately 15 per cent of the total 6,611.13 kw figure.

Referring to the 1934 jobs, the 70 residential installations account for the largest number in any classification, but the 33 office installations account for the largest kw figure (283.46). The 7 restaurant and bar installations represent 140.21 kw, and the 10 retail store jobs account for 112.05 kw.

Similar figures for a number of cities were reported in an article in the January 1935 H. P. & A. C., and a supplementary article last month gave the figures for two additional cities. The figures for St. Louis were compiled by E. A. Freund of the Union Electric Light & Power Co., whose courtesy in making them available is acknowledged.

Summary of Air Conditioning Installations, St. Louis, Mo.

Type of Building	Prior to 1933		During 1933		During 1934		Total to Dec. 31, 1934	
	No. Jobs	Kw	No. Jobs	Kw	No. Jobs	Kw	No. Jobs	Kw
Bakeries	6	30.35	1	16.50	..	....	7	46.85
Banks	..	....	..	....	2	47.75	2	47.75
Beauty Parlors	..	....	..	....	2	3.25	2	3.25
Breweries	..	....	..	....	1	34.50	1	34.50
Hotel Dining Rooms and Coffee Shops	8	488.13	2	60.00	3	52.00	13	600.13
Industrial Processes	5	669.60	4	91.50	1	9.00	10	770.10
Miscellaneous	1	32.00	5	48.75	5	21.15	11	101.90
Offices	19	76.53	21	84.56	33	283.46	73	444.55
Office Buildings (Complete)	1	300.00	..	....	1	53.00	2	353.00
Printing Plants	..	....	..	....	1	36.00	1	36.00
Residences	24	43.25	34	64.50	70	107.35	128	215.10
Restaurants and Bars	5	274.00	1	42.00	7	140.21	13	456.21
Retail Stores	8	252.50	7	260.75	10	112.05	25	625.30
Sales and Display Rooms	6	61.00	4	9.50	7	26.36	17	96.86
Service Stations	..	....	..	....	1	4.00	1	4.00
Studios, Broadcasting	..	....	..	....	2	14.13	2	14.13
Theaters	7	2,654.25	1	15.00	2	66.75	10	2,736.00
Undertakers	1	16.00	..	....	2	9.50	3	25.50
Total	91	4,897.61	80	693.06	150	1,020.46	321	6,611.13

Plant Engineer Licks Problem of Removing Moisture-Laden Air

By **L. Duckman***

ONE hundred and forty open vats filled with water at the boiling point made conditions in a room at the Oscar Heineman Corporation plant (silk) not only extremely uncomfortable but dangerous. The volume of steam and vapor in the room made it impossible to see if a vat was full or empty or whether the faucet above each vat was open or closed. In addition to the danger of accident thus involved, the men had to work half-stripped in order to be at all comfortable.

Several attempts were made to correct these conditions. One scheme tried was to introduce air to the room at relatively high temperatures with the hope that the heated air would prevent condensation of the vapor in the room by absorbing the moisture and carrying it off. This made conditions worse than before, increasing the temperature but not removing the moisture. Exhaust hoods over the vats were then tried, but it was impossible to pull the moisture laden air rising from the vats into the hoods.

The plan we finally worked out and which performed to our entire satisfaction was to suck air out of the room through six openings along one wall 4 ft 4 in. above floor level, discharging the moisture laden air up an available stack. The volume of air pulled across the room is great enough to keep the room entirely free of fog and make the conditions as comfortable as those in the plant offices.

The sketch reproduced here is a rough plan of the room showing the location of the exhaust outlets. The room is approximately 60 ft by 60 ft and has a ceiling height of 11½ ft. The vats (each a cubical box open at the top 30 in. by 30 in. by 30 in.) were located[1] along the walls of the room and in a row down the center.

Six openings 22 in. by 30 in. were cut in one wall of the room with the bottom of each opening about 52 in. above the floor. A suction chamber was built on the opposite side of this wall, and is divided in two sections so that three of the exhaust openings connect to each half of the chamber. From each of the two parts of the suction chamber, a fan exhausts the air and discharges it up a stack. Each of these two fans has a capacity of 25,000 cfm and an outlet velocity of 2600 fpm against a static pressure of ¾ in., and is driven by a 10 hp motor. A baffle wall in the stack prevents the fans from discharging against each other.

The idea of this scheme is to maintain a steady flow of air from one side of the room over the vats to the wall in which is located the exhaust openings. In this way the vapor is given no chance to collect in the room, but is pulled out as soon as it is formed and discharged

Sketch showing plan of room in which 140 open vats were located. The exhaust system described does an effective job of removing the vapor-laden air

up the stack. For best results the bottoms of the exhaust openings should be about 1½ times the height of the vats above the floor and the openings should be spaced as evenly as is possible.

It will be noted that air gets into the room through two doors, and through two air supply openings which were cut in the wall opposite the wall in which the exhaust openings are located. Conditions would be some what improved if there were an air supply opening in the corner of the room marked "A" on the sketch, as the air circulation in this corner is not as good as would be desirable. It was impossible to provide an air supply opening in this wall because of the plant layout.

An arrangement such as this can be used to advantage in many plants where it is necessary to remove moisture-laden air arising from open vats. Frequently it is impossible to use exhaust hoods because of other equipment over the vats and sometimes it will be found—as was our experience—that exhaust hoods will not do an effective job.

[1]Most of the open vats have since been replaced by enclosed type soaking machines, due to a change in our process.

*Plant Engineer, Oscar Heineman Corp., Chicago, Ill.

DIFFUSION OF CONDITIONED AIR

Drafts and other results of faulty air distribution are probably the most common causes of complaints about both winter and summer comfort air conditioning. Avoiding such objections is our subject here

By **Samuel R. Lewis***

THE comfort air conditioning system's "customer" is the occupant and he must be satisfied if the job is to be a success. Many a system—central or unit type—otherwise excellent falls down at the last step—getting the conditioned air to the customer. Probably more complaints are due to poor air distribution than any other single cause.

The matter of introducing cooled or warmed air to the room requires careful consideration if complaints are to be avoided and the system is to fulfill its object. Our purpose here is to indicate solution of the problem.

Use of Same Units for Heating, Cooling

A type of heating and cooling system which has a number of advantages in both new and existing buildings comprises fan-equipped convector units in each room through which is circulated hot water—or other liquid—for heating in winter and cold water—or other liquid—for cooling in summer, the same piping being used at all times. A system of this kind of the author's design is now being installed in a new office building in Chicago and will be described in detail in a later article; for this job, the cold water which is circulated through the units is supplied by a centrifugal water vapor refrigeration machine.

The production of very quiet fans and motors and of compact heat transferring convectors has developed until room units are available which occupy no more space than that taken up by old style radiators. The advantages of the system, from the author's viewpoint, include the use of most of the equipment for both heating and cooling, and the possibility of installing the units, piping, etc., for heating only so that a refrigeration machine can later be installed to provide cooling without the necessity of replacing the units, putting in new piping, etc.

Providing Ventilation with Unit Apparatus

It is possible to provide ventilation for rooms which have unit cooling and heating apparatus *via* the windows, but window ventilation is almost uncontrollable, air distribution using windows is unsatisfactory, and open windows make for dirt and noise. It is wiser to provide year 'round controlled ventilation by ducts, with new air filtered and moisture-adjusted; since perhaps only 1/3 of all the air moved need be thus delivered through ducts, these ducts can be comparatively small in size. Fan-equipped convector units and air supply ducts, air filters and humidifiers can be installed in existing buildings with perhaps an exhaust system for the removal of the heated air from the higher rooms or from the upper parts of every room. Such an exhaust system especially is valuable on summer nights, during which in most localities the temperature outside falls 20 F below the hottest hour of the preceding day.

It is just as necessary—perhaps more necessary—to provide individual room control of the temperature when cooling as when heating. A person will tolerate a temperature 5 or 10 F too warm with much better grace than a temperature 5 or 10 F too cool.

It is possible to deliver the new cool air in summer to any room through the same ducts and registers which are used when heating—especially if the new air temperature is not much warmer or much colder than the room air. The maintenance of a comparatively slight temperature difference can easily be arranged if the recirculated part of the air movement is accomplished within the room itself.

Figs. 1 to 3 are elevation sketches of a unit recirculating heating-cooling machine in an office. Use of the outlet shown in Fig. 1 almost invariably leads to discomfort even when the entering air is at low velocity and is as little as 10 F colder than the air in the room. The outlet shown at Fig. 2 is very much more satisfactory in summer than that in Fig. 1, but there must be sufficient velocity to cause diffusion overhead before the cooler air touches the occupants. In Fig. 3 the same outlet, if used in winter, should be increased in width so as to reduce the air velocity and to diffuse the warm entering air and the recirculated air chilled by the window in a zone nearer to the floor than in summer. If the outlet shown in Fig. 1 is employed in winter with a slow velocity it gives excellent results, with a ceiling temperature and fuel consumption less than those attained with the outlet of Fig. 2. The conclusion is that for best results using a floor mounted unit against an outside wall, there should be two outlets; both adjustable as to velocity of discharge, one for summer and one for winter. With any design of outlet, the less the reservoir of air above head level is disturbed, the more economical will be the heating and the cooling.

Introducing Conditioned Air to a Room

The conventional register looking from an interior wall toward a window gives constant difficulty. When the entering air is warmer than the room air the circulation is

*Consulting Engineer, Chicago, Ill. Member of Board of Consulting and Contributing Editors.

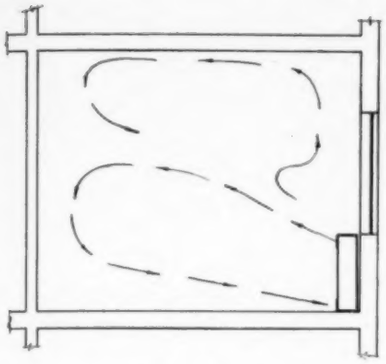


Fig. 1

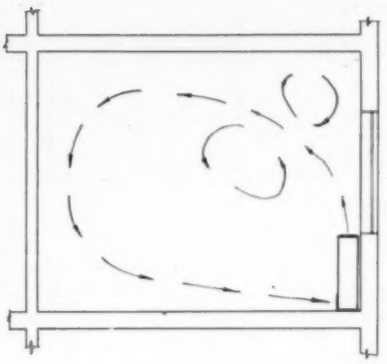


Fig. 2

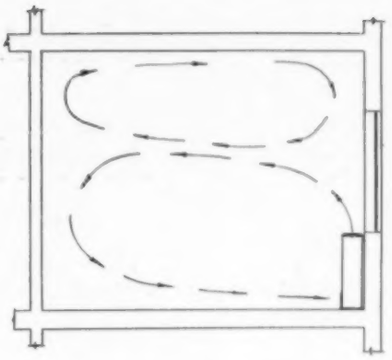


Fig. 3

as indicated in Fig. 4, with little diffusion and with definite drafts. When the entering air through such a register is cooler than the room air the entering air falls toward the floor as in Fig. 5 and there is great complaint —with justice—of drafts. One sees many old ventilating systems with inclined glass plates in front of the registers, placed there in the hope that the too-cold air would rebound against the ceiling and thus achieve some diffusion.

The most reasonable solution where a side wall register must be used would be to use an injector type diffuser with plates or vanes (Fig. 6) which will use the high velocity of the entering air to induce a secondary movement of the room air, thus promoting the mixing of the new cool air with the warmer air of the room, before permitting the new air to touch the occupants. These injector type diffusers often use as high as 2000 fpm air speed through the free area without objectionable noise.

Fig. 7 illustrates a circuit of the air from the supply opening to the return air opening which has given excellent results both for heating and for cooling. Since in any ventilating system the entering air is or should be somewhat cooler than the room air, both in winter and in summer, there is no tendency for short circuiting with the arrangement of Fig. 7. In offices one such outlet preferably is placed in the center of each construction bay. For residences the ducts can reach the diffuser by running between joists or rafters.

The arrangement of Fig. 8 serves satisfactorily for residences, both when heating and when cooling, especially since in residences the occupants can move away from any draft. When cooling, of course, there must be provided enough air speed to bring about diffusion and to prevent stratification such as is indicated in Fig. 9 and which does occur in many carelessly operated cooling plants.

[Continued on page 146]

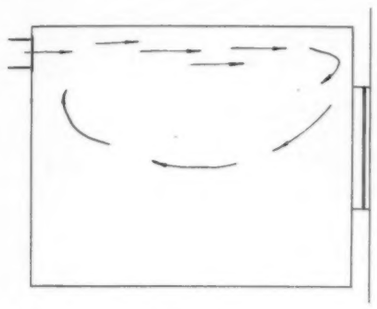


Fig. 4

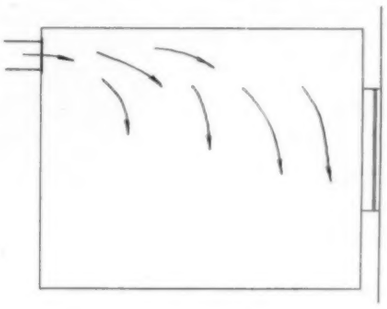


Fig. 5

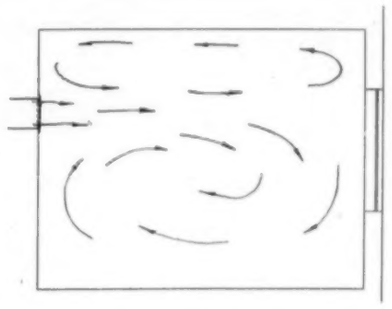


Fig. 6

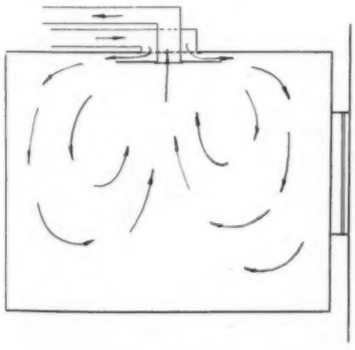


Fig. 7

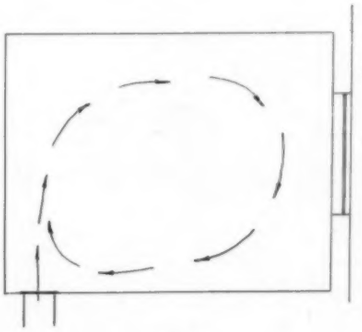


Fig. 8

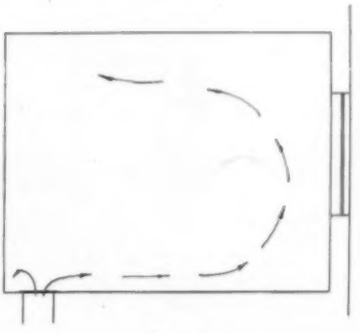


Fig. 9

Dam Builders Live in Electrically Heated City

BUILT by the Mason-Walsh-Atkinson Kier Company—the group of contractors for the first unit of the Grand Coulee dam on the Columbia River —to house the contractors, their employees and families, Mason City, Wash., is to serve as a laboratory for the study of electrical space heating by the college of mechanical arts and engineering of Washington State College. A number of the larger homes will be air conditioned, and the smaller homes will have electric refrigerators, electric ranges and electric heat and lights. Of a group of twelve of the houses selected for particular tests, ten will be insulated in various ways and two will be uninsulated.

In these twelve buildings recording meters will determine the electrical load curve and peak load, and recording thermometers and humidistats will show the conditions maintained. Purpose is to study the most economical use of electricity for heating, summer and winter air conditioning, the practical use of off-peak power for storing heat, etc. In the study of heat storage it is planned to use various methods, including water storage, rock storage, brick storage, and other as yet undetermined means.

The buildings heated electrically include the administration building, the 2200 seat dining hall, and general office buildings, but not the two story general store, or the hospital.

Mason City will exist only during construction of the dam, after which it must be removed. Portable electric heaters are expected to have a high salvage value, and eliminated digging of basements, putting in foundations, and the later filling in of excavations. The inaccessibility of the damsite from the angle of transporting coal or other fuel was an important consideration. Plans call for heaters of from 1½ to 6 kw in each of the rooms in every building, 3500 being needed for the first 360 houses. Juan Hargrove, the architect, and the engineer who worked out the electrical heating, estimate that the cost of the heaters is about $5 per kw, and the cost of installing and equipping a five room house to be approximately $160.

Part of the main dining hall, which is electrically heated

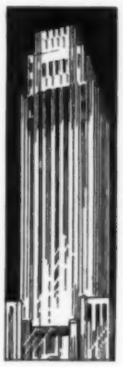
In addition to the 360 homes, and the dining hall, blocks of bunkhouses, a girls' dormitory, two office buildings, a garage, schools, a theater, churches, and business houses,—all are to be electrically heated. One of the office buildings has fifty separate offices.

On another big construction project—the Colorado River Aqueduct ——, cooled bunkhouses enable men on the night shift to sleep during the hot desert days. Air, cooled by passing over coils through which water is circulated, enters the sleeping rooms through ceiling registers, is exhausted through the corridor, exhausts through a grating to the unfinished space beneath the roof. The water is cooled by evaporation in a cooling tower. This view shows one of the camps, a water tank in the background, and the cooling tower. . . . The hospital at the Berdoo Camp is air conditioned, a compressor supplying refrigeration.

• • • Air Conditioning—from the Building Owner's Viewpoint

By **Paul E. Holcombe***

WHEN there comes to my attention each new story of another building in which air conditioning has been installed," states the owner-manager of a successfully operated group of buildings, "I pause to ponder my own reactions over the last few years. Feeling it a duty as well as an inducement to tenants, I make it a practice to consider new types of services—of which air conditioning has been one. In our cold winter climate, humidification seems to be more important than summer cooling, but after a session with an air conditioning engineer, when I hear again of the expense and practical difficulties in conditioning my building, I re-suffer a sort of mental relapse."



It is evident that building owners and managers of commercial buildings, whether of office, loft or apartment tenancy are thinking about air conditioning, if for no other reason than that some of their brothers in the profession have already acted rather than only thought. Systems actually doing air conditioning jobs and those which were installed on the understanding that they *would* provide air conditioning, have been in use and the word is about that tenants are attracted to those buildings.

However, we hear stories of unsatisfactory air conditioning systems. When we hear of building owners and managers being hard to convince, there is good chance that those hard-boiled prospective buyers have in the back of their minds such stories and experiences. They remember instances where the right system was put in the wrong place, or *vice-versa*. They have known of an air washer standing idle and rusting for years or they have been in a so-called conditioned building where the air washer was not idle but should have been, because the humidity was almost like the proverbial fogs of London. Others have gone into restaurants on a hot summer's day for a rib of beef, but have come out with a stiff neck. They have been in theaters where the combination of a snow scene on the screen and the cold air on their feet have caused a fast but not painless transportation from July to January. Others have seen the air conditioned space in a partially treated building rented at a lower rate than adjacent unconditioned space.

The majority of building owners and managers are not technically trained. It adds to their confused reaction when thinking about air conditioning to listen to a glib discussion of the invigorating effect of removing Btu's from a room on the wings of so many grains of moisture per cubic foot of air to make an effective temperature well within the range of a comfort zone on a psychrometric chart. When there is added to this the fact that the psychrometer is a combination of the wet and dry bulb thermometer and that by this one can measure the dewpoint, some of the prospective buyers feel like going to the mountains in the summer and to the South Seas in the winter where Nature is thought to care for such things. The bad feature is, however, that the investment angle in the building business is not now such as to provide such trips and probably it never was. So the building owner and manager is really interested in learning about air conditioning.

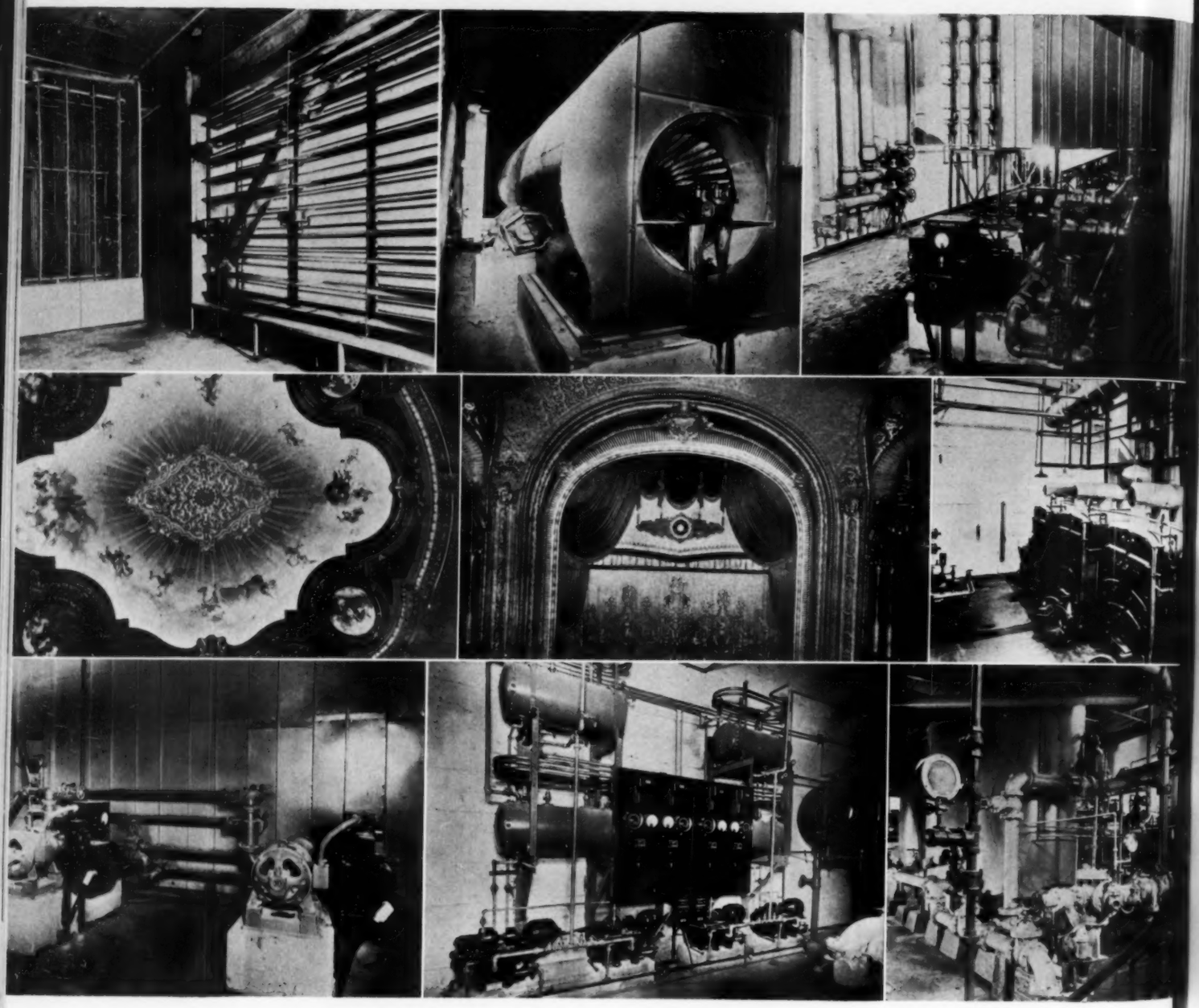
That there is a decided lack of understanding of what air conditioning is, is well exemplified in a recent statement by one of our members:

"The air conditioning industry," he said, "has had peculiar sales resistance due to the unfamiliarity of the average layman on the subject. First, the inability of understanding what air conditioning means, lacking any basis of comparison. That is, it would be difficult indeed to describe to the average person the beauty of a trip through the mountainous country had he never seen a mountain. Second, the passive resistance of the average person used to a certain condition over a long period of time and unable to realize that it is as necessary to the efficient conducting of his business to have comfortable conditions in summer as it would be in winter. Third, a confusion in the layman's mind as to the difference between air conditioning and air cooling when used to control temperatures. Many installations using no refrigeration in the air cooling spray, resulting in high wet bulb temperatures and consequently lack of humidity control, are advertised as air cooling systems. The party spending many thousands more to provide refrigeration in the air cooling spray with resultant humidity control is thus at a distinct disadvantage with a simple air washing system which does provide a lower-

(Continued on page 143)

*Research Engineer, *National Association of Building Owners and Managers.*

Undoubtedly there is confusion among prospective purchasers of air conditioning. Some is justified—installation of an air conditioning system is an engineering problem, is not as simple as many think. But confusion is also caused unnecessarily—by lack of experience data, the meaning of "air conditioning", etc.



LEFT TO RIGHT, TOP ROW—The air conditioning room of the Fox Theater, San Francisco, occupies an entire floor nine stories above the street. The intake shutters seen here are under automatic control. . . . This main supply fan (one of 16) delivers 140,000 cfm, is operated by a 50 hp motor. . . . Eight 14 ft main supply ducts lead from the air conditioning room to various parts of the theater. Each duct has a series of three steam heaters operating at a variation of ½ F

SECOND ROW—The perforated plaster about the central dome distributes the conditioned air. There are 414 separate openings in the theater, each one having its own damper control. . . . Perforations for admitting conditioned air are located above the proscenium arch and in the domes above the organ lofts. . . . The boiler room, in the basement 20 ft below sea level. The 5 ft x 20 in. oil tank is under the floor at the far end. The oil pumps on the left are equipped with a preheater which brings the oil up to the point of combustion

BOTTOM ROW—Deep well water is pumped from the basement to the air washers by these pumps operating at 1750 rpm. . . . Air pressure on the hydro-pneumatic tanks is maintained by four compressors. The end of the centrifugal pump seen at the right is one of two used to pump water from the theater's own deep well. . . . The reserve 6000 gal hydro-pneumatic air washer system. In case the air washer pumps should not function this system can be used for air washers, fire fighting or flushing purposes

Reader Clifton G. Reynolds, Superintendent of the Fox Theater, is responsible for the operation of this air conditioning system

H.P.&A.C. INSPECTION TRIPS

BEGINNING with the boiler room 43 feet below street level and ending with the broadcasting floor 14 stories above, the Air Conditioning Society of San Francisco recently inspected the air conditioning and mechanical equipment of the Fox Theater under the guidance of Charles T. Phillips, designer of the installation, and Clifton G. Reynolds, superintendent of the theater. The illustrations on the opposite page show several of the heating and air conditioning features of this installation.

This 5,000 seat theater was planned in 1924-26, and was completed in the early part of 1929, opening for business in June of that year. It is the only theater in San Francisco with down-draft air circulation, according to Mr. Reynolds. The exhaust openings under the 5,000 upholstered seats number well up into four figures.

In handling the air conditioning problems of a theater such as this covering a city block, considerable alertness is required. For instance the 210 ft from the projection room to the screen must be kept clear of tobacco smoke for projection reasons. Air at 85 F with 10 per cent relative humidity may travel 300 fpm quite acceptably, but air at 61 F and 90 per cent R. H. must be cut down to 50 or 100 fpm to overcome objections on account of draft. Body heat and the bearing it has on boiler operation is also interesting. Under ordinary conditions a full house will develop 1,800,000 Btu per hr in body heat, but under excitement when breathing and heart action is more rapid, this may be increased to 2,250,000 Btu in a few minutes. This has an influence on plant operation.

Box Office Value of Air Conditioning

Another item of interest is the box office value of air conditioning. Engineers are aware that under most perfect obtainable conditions possible, as much as 10 per cent of the people affected may be dissatisfied. In a house of this size, this means 500 persons, and they are the ones who register complaints. If an engineer allows himself to be influenced unduly by complaints, he is apt to make conditions uncomfortable for 4,500 other contented persons, and the box office value of a good entertainment may be impaired.

The box office may also be helped by using a good supply of make-up air; the test has frequently been made in this theater. The body heat of a large assemblage can be used profitably in reducing fuel bills and other expenses of boiler operation, but bypassing of air should not be carried to extremes, says Mr. Reynolds.

The luxuriousness of the appointments of this theater is indicated in one or two of the pictures reproduced here. Mrs. William Fox was personally responsible for all of the decorative and furnishing scheme.

San Francisco's 5,000 Seat Fox Theater

Building Owner's Viewpoint—

[Continued from page 141]

ing of temperature, but any length of stay in such a place later brings that wet, sticky, oppressive feeling of excessive humidity. The public reaction is that all air conditioning is palaver. This is partly the fault of the air conditioning industry itself, as there is no word or phrase to give purchasers of completely refrigerated air conditioning systems any protection.

"I believe there is a need for the air conditioning industry to endeavor to bring before the public what complete air conditioning means, and some method of protecting the buyer of complete equipment. Undoubtedly, a completely conditioned building can secure better rents and will have more satisfied tenants."

I am confident, from many interviews with building owners and managers, that this reflects a cross-section attitude of the industry.

Of course, there has been a great deal of literature describing what air conditioning is, but why is there not a combined frankness by the industry? Possibly there will never be a control of the personal information given to prospective clients, but it would seem only the part of wisdom to have a general coincidence of opinion in the written word of manufacturers and designers to customers.

The following suggestions may point the way to a clearer understanding of the subject, benefiting both customers and suppliers.

Suppose the industry agrees on a definition as—"Air Conditioning is the simultaneous control in an enclosed area of the (1) temperature, (2) humidity, (3) motion and (4) cleanliness of the air." It would then be well to include this definition in all literature on air conditioning to make that definition widely familiar. Then the various units and systems can be classified as: 25 per cent; 50 per cent; 75 per cent; or 100 per cent depending upon the actual accomplishments as compared with the definition.

The owner and manager next wants to know how he can get air conditioning; of course as inexpensively as possible. There, too, should be some agreement by designers. Well water in one location will provide sufficient cooling, but just because one prospect may know of such a successful installation, his unknowing insistence is not sufficient reason for a designer or manufacturer to recommend such a system for his building when it cannot possibly provide him with air conditioning. The guarantees given the buyer in some instances have been so ambiguous as to be only evasion. The buyer becomes a goat—*caveat emptor.*

The prospective customer is probably most interested in the economies of his proposed system, whether it can be paid for, necessarily by his tenants, either in the form of rent or as a separate item. Many feel now that it is a sign of obsolescence not to have air conditioning, others will not realize it until "the fellow down the street pulls a fast one and installs a system."

For the development of the industry it is necessary that more experience data be available to prospective customers, both as to costs and as to results. The building owner and manager wants to know why he should spend from $50,000 to $500,000 for an air conditioning system, and it is not enough for him to have only thoughts of what he might gain. He must have facts upon which he can base his judgment.

"Somebody's Connected a Water Line to My Air Line"

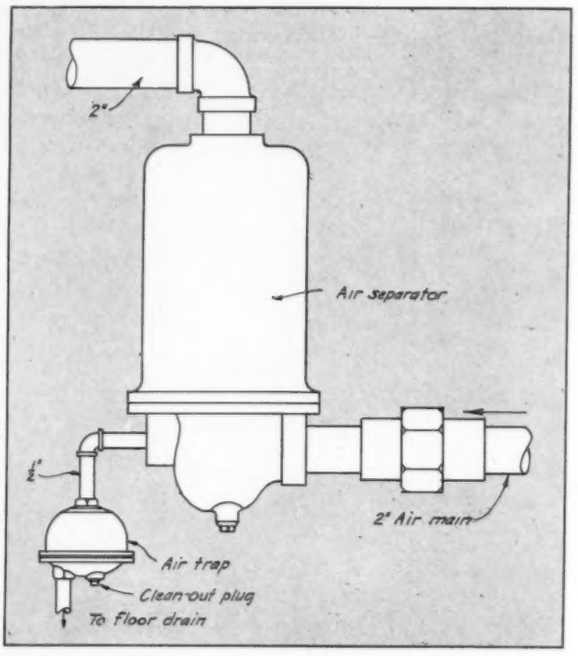
By **John W. Hieronymus***

SOMEBODY has connected a water line into my air line!" That was the cry of a foundry foreman on a foggy, rainy morning after a foggy, rainy night, and one look at his vibrator type of moulding machine would have convinced almost anyone that such was the case. But conditions were not as bad as that. The long air line from the air compressors through the foundry and to the moulding machine acted as an aftercooler for the moisture-saturated compressed air, cooling it to a dewpoint which released moisture to such an extent that it appeared to come from some source other than natural condensation.

To show what happened, let us consider a pound of outdoor air, compress it, take it through the piping system to the moulding machine, and see what occurs. Assume an outdoor temperature of 65 F and a relative humidity of 96 per cent. At this temperature and R. H., the air will contain about 90 grains of water vapor per lb of dry air. Compressing this air six atmospheres, or to 75 lb gage pressure, will increase the water content six times or to approximately 540 grains, which would equal a relative humidity of "600 per cent" if the temperature of the air remained at 65 F. But, just as we confine 540 grains of moisture into a space one-sixth of that which it originally occupied at atmospheric pressure, we also confine the Btu content of six cubic feet of free air into one-sixth of its original space, increasing the theoretical temperature of the air to over 400 degrees; with the best water-jacketed cylinder, the actual temperature of the air leaving the compressor will be over 300 F, and the air will easily carry the 540 grains per lb of water vapor. In fact, the temperature of the air will have to be reduced to approximately 115 F before we again have 100 per cent relative humidity, or to bring the air to the state where the water vapor will condense out.

If an aftercooler of ample capacity is installed to cool the air to 60 F, most of this moisture will be "squeezed" out, and, if there is an effective separator in the system, no water trouble would be encountered. This however is not always the case. Often the aftercooler is too small, due to (1) addition of a compressor, without adding the necessary aftercooler; (2) the aftercooler loses its efficiency due to oil on the air side, sediment on the water side, or tubes plugged by debris (even fish have been found wedged in at the entrance of a tube). The best to be expected from the conventional type of aftercooler when first installed is discharge air at 20 F higher than the incoming cooling water, and after being in operation, this temperature difference increases and in the majority of cases the air is 100 F or even higher.

Assuming, for a matter of demonstration, that this air entered the piping at 115 F, it then carried with it about 540 grains of water vapor per lb of air. As the air cooled in its travel through the main, the moisture in excess of 100 per cent relative humidity settles out of the air and forms a stream at the bottom of the pipe line. For the first 20 F drop in temperature, over 200 grains of moisture per lb of air will be released. If there is no further condensation, and the air reaches the machine at 95 F, this amount of water will be discharged with every pound weight of compressed air, and the mixture will have the appearance of being more water than air.



By installing a separator and trap the moulding machines were supplied with dry compressed air

It is self-evident that moisture-laden air decreases the efficiency of any air-operated machine, and causes real damage as may be the case in the high speed air turbines or the knocking out of a cylinder head in the piston type of machine, and general abuse of all moving parts and packing. The chief disadvantage of moisture in air used for mechanical purposes is its washing away of the lubricant supplied for the machine. In this case, the moisture may be so little as not to be noticed, or thought to be harmful. Yet it is counteracting the effects of lubrication.

In the case of the foundry mentioned, a separator and trap were installed at the end of the main supplying the group of moulding machines as shown in the sketch. This proved to be a very effective remedy.

*Engineer, Barrett-Christie Co., Chicago, Ill.

Cost of Heating Cut by Putting the Heat Where It's Needed

PUTTING the heat where it is required is one of the most effective methods of reducing heating costs. The principle of applying the heat so that it will best serve its purpose is that which underlies the modern unit heater, zone and other control equipment, and other plant and building heating apparatus.

Economical generation of steam for heating purposes means little unless that steam which is so economically produced is economically utilized. One operating engineer, who was very proud of his low cost per thousand pounds of steam generated, found he was wasting about 20 per cent of the steam needlessly because of his method of using it. No matter how little it cost him to produce this 20 per cent of the steam, it was pure waste.

An example which proves the economy of putting the heat where it is needed is the recent installation of two 455 sq ft unit heaters in a modern seven story building of the light manufacturing type. One of the tenants of this building is a printing firm and the units are installed (as shown here) to warm up the printing presses.

Before the units were installed it was necessary to heat up the entire building three or four hours earlier than is now necessary in order to warm the metal presses. It took a long time to warm up this mass of metal, which was necessary before the printer could start operations, as the cold metal hampered the flow of ink and led to other difficulties. With the units located as shown to blow warm air directly on the presses where it is needed, this three to four hour heating-up period is eliminated and the tenant can start operating as soon as the men are on the job.

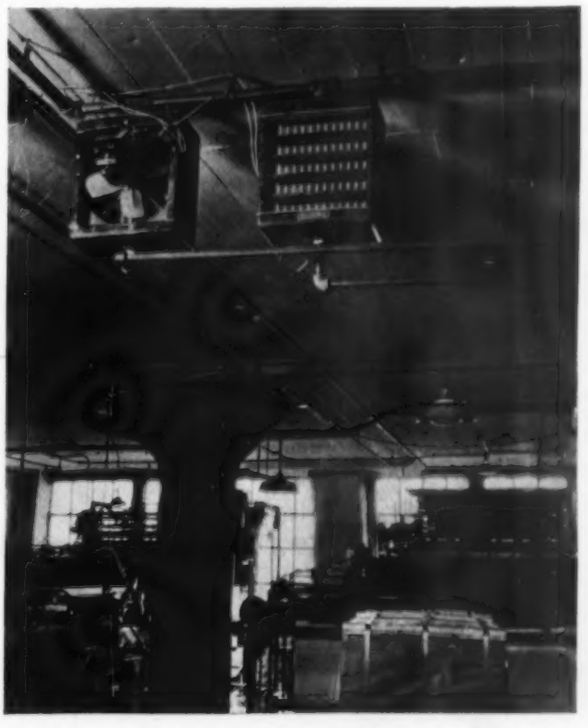
As the walls of the building are about 85 per cent glass, cutting down the daily heating-up period has resulted in real savings in coal. For instance the coal consumption for January and February, 1933 was 418 tons and for January and February, 1934 was 379 tons. After the unit heaters were put in (December, 1934) the coal consumption for January and February, 1935 was 324 tons. Degree days for these two months for 1933 were 1964; for 1934, 2191; and for 1935, 2207. Thus in 1933, approximately 0.21 tons of coal were used per degree day for these two months and in 1934, 0.17 tons of coal were used per degree day. The corresponding figure for 1935 is 0.14.

The units were installed by the building engineer and the printing firm's maintenance engineer. In addition to making the fuel savings described and improving press operation, the units keep the press room more comfortable for the workers than before.

Another case of putting heat where it's needed involves a large office building with the tenant occupying the basement, first and second floors requiring heating service twenty-four hours a day. By arranging to shut off the risers above the second floor, worthwhile savings have been secured.

An air operated valve was installed in each riser at the third floor. These are operated from the basement and enable the engineer to shut off steam on all floors above the second. By using a three way valve it is possible to heat up any one or more risers above the second floor if a tenant on an upper floor requires heating service at any time.

Before these valves were put in it was necessary to heat practically the entire building for the benefit of but the basement and the first two floors. The economy advantage of zoning the heating system in this way is obvious.



These two unit heaters save their cost many times over in reducing amount of coal required for heating. Before the units were put in, the entire building had to be heated up to warm the printing presses, two of which are seen in the background

Fig. 1—Welded joints give assurance that this 9 in. cement pipe-line will withstand every stress in its 1000 ft drop to the canyon below

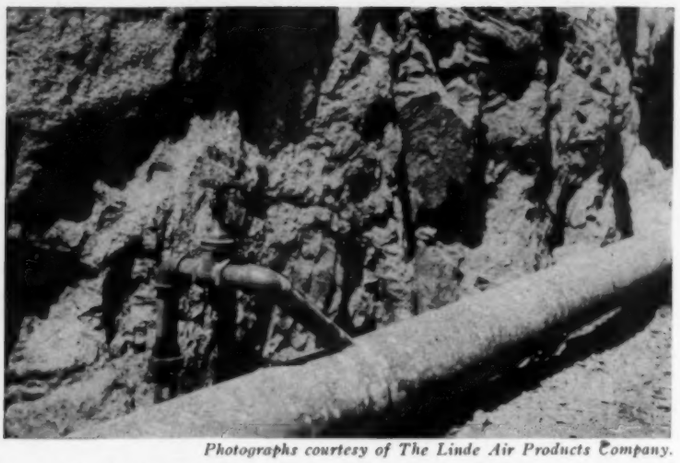
Cement Piped at Boulder Dam

TWO welded cement transmission pipe lines in use on the Boulder Dam project convey an amount of cement equivalent to 44 carloads daily. Starting from the blending plant, where the different types of cement are mixed, the dry cement is delivered to a pneumatic pump at the head of the line; thereafter the cement is pushed along by air from 2 in. inlets which are oxy-acetylene welded to the line at intervals of 200 ft.

The 6 in. pipe line goes to the silo of a nearby mixing plant, which is 4,000 ft upstream from the dam; the 9 in. line (Fig. 1) runs alongside a rocky bluff, dips slightly at the edge of a cliff, and plunges down with one drop of more than 1,000 ft to a mixing plant at the bottom of the canyon. This line is over 3,500 ft in length and conveys cement at the rate of 450 bbl per hr.

Fig. 1 shows the line at the beginning of its nearly vertical descent. Steel A-frames anchored to the walls of the canyon and cables are used in supporting it. Even with this support it was essential that the joints in the line be as strong as possible in order to withstand the stresses. Every joint was oxy-acetylene welded with the exception of flanged joints every 300 ft which are so placed to facilitate quick replacement should any section become obstructed. A flanged section and a bend in the pipe are visible at the upper left of Fig. 1. In all instances the flanges were welded to the pipe.

The air inlets (Fig. 2) are provided with a valve control permitting the air in the line to be maintained at a pressure of 150 lb per sq in. Before use the lines were tested at a pressure of 200 lb per sq in.; no leaks were found in any of the approximately 200 joints.



Photographs courtesy of The Linde Air Products Company.

Fig. 2—An air inlet with a valve to keep the pressure at 150 lb per sq in. is shown oxy-acetylene welded to the dry cement pipe line

The welding was done by a recently developed process, chief characteristics of which are employment of a back-hand technique, a carburizing flame, and a special welding rod.

The welding blowpipe has found many other applications in the pipe construction jobs at Boulder Dam. One of the most outstanding was in the dam itself, where 1 in. piping for the cooling of freshly poured concrete was installed. About 850 miles of this piping has been laid, with every joint welded.

Diffusion—

(Continued from page 139)

The type of register shown in Fig. 10 often is used in residences. There must be enough air speed to cause diffusion when cooling, and low velocities at that time assuredly would make the occupants uncomfortable. The registers of Fig. 10 should have vanes to deliver the air

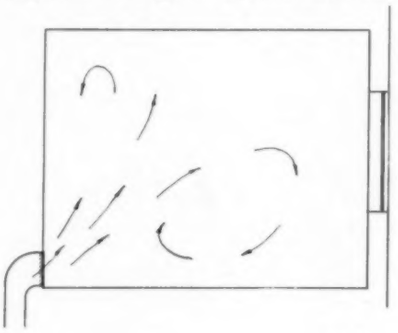
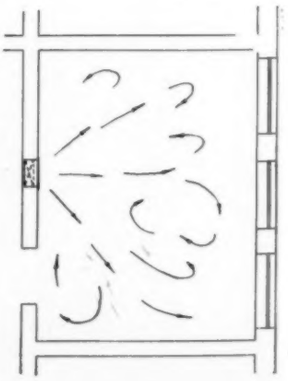


Fig. 10

Fig. 11



jet upward at an angle and a velocity of not less than 500 fpm at the register is desirable. The air should be delivered not only as indicated by Fig. 10, a cross section, but in plan should have at least three-directional vanes so as to diffuse fan-wise as suggested in Fig. 11.

Heating·Piping
and Air Conditioning

American Society of Heating and Ventilating Engineers JOURNAL SECTION

MARCH 1935

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A Carbon Monoxide Alarm and Ventilation Control

By **F. C. Houghten*** *(MEMBER)* **and Linwood Thiessen†** *(NON-MEMBER)*

Pittsburgh, Pa.

CARBON monoxide poisoning is recognized as one of the four major industrial hazards. It is met with in the home, resulting from imperfect combustion of natural gas, oil, or solid fuels, accompanied by improper elimination of the products of combustion. Casualties frequently result from exhaust gases of automobiles whose engines are allowed to run in single car garages with closed doors. Workmen in large commercial garages and other industrial establishments without proper ventilation, frequently suffer headaches and other symptoms, while less frequently they must be removed in an unconscious condition for hospital treatment.

The ventilation of commercial garages and vehicular tunnels to eliminate this hazard has received a great deal of attention during the past several years. A committee of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS in developing a code for the ventilation of garages was confronted with a need for more technical data concerning the production of carbon monoxide by automobiles, and satisfactory methods for and the amount of ventilation required to insure satisfactory conditions at a minimum cost. Studies made by the Research Laboratory[1,2,3,4] have supplied much of this information. A very great need has persisted for a satisfactory and reliable instrument at a reasonable cost to either indicate the carbon monoxide concentration in the space to be ventilated, or to be used for automatically controlling the air supply in order to hold the carbon monoxide concentration below the limits of safety.

The pyrotannic acid method[5] and the iodine pentoxide method[6] of analyzing samples of air for carbon monoxide have been available for laboratory purposes, but they are of no value to the operator of a garage. The Bureau of Mines carbon monoxide recorder,[7] developed by Katz and others, is admirably suited for this purpose. It has, however, a much higher sensitivity than necessary, and its cost is beyond the reach of most applications. It has been successfully used in large establishments, such as the Holland Tunnel.

Largely as a result of the need expressed by the Society's Committee on Ventilation of Garages, the Mine Safety Appliances Co. of Pittsburgh, manufacturers of the Bureau of Mines carbon monoxide recorder, was induced to undertake the development of a less but sufficiently sensitive and much less expensive instrument based upon the same principle. This effort has finally resulted in the instrument here reported, which is believed to be sufficiently sensitive and reliable for the purpose.

The principle of measuring the carbon monoxide concentration of the air made use of by Katz and others in the Bureau of Mines carbon monoxide recorder is based upon the rise in temperature of air while passing through an oxidizing catalyst which oxidizes the carbon monoxide contained in the air to carbon dioxide with the liberation of heat. The resulting rise in temperature is indicated and recorded as an emf by a compound thermocouple with alternate junctions so placed that the air passes through one set before and through the other set after passing through the catalyst. In order to insure the extreme sensitivity desired in the Bureau of Mines carbon monoxide recorder, it was necessary to resort to a complicated system of purifying the air of its moisture content, dust and other oxidizable compounds, including partially burned gasoline and other hydrocarbons, without affecting its carbon monoxide content before it passed through the active cell. Fig. 1 is a photograph of the Bureau of Mines carbon monoxide recorder. The oxidizing catalytic agent used in the cell is known by the trade name of Hopcalite, and was developed at the United States Bureau of Mines during the World War as an important reagent for use in the canisters of gas masks.

A photograph of the carbon monoxide alarm and control as used in this study is shown in Fig. 2. A diagrammatic drawing of the instrument is shown in Fig. 3. Air from the space to be ventilated is drawn through the dust filter, *A*, by the fan, *B*. It then passes over the electric heater, *C*, and divides through the two cells, *D*, and *E*, one containing a granular material activated with Hopcalite, and the other containing an inactive granular material of the same resistance to the flow of air and of the same heat capacity. A compound thermocouple with alternate junctions, *F*, in the two cells sets up an emf depending on the temperature rise in the active cell. The emf resulting from the rise in temperature due to the

*Director, Research Laboratory, AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.

†Graduate Student, University of Pittsburgh.

[1]Carbon Monoxide Distribution in Relation to the Ventilation of a One-Floor Garage, by F. C. Houghten and Paul McDermott. A. S. H. V. E. TRANSACTIONS, Vol. 38, 1932, p. 425.

[2]Carbon Monoxide Distribution in Relation to the Ventilation of an Underground Ramp Garage, by F. C. Houghten and Paul McDermott. A. S. H. V. E. TRANSACTIONS, Vol. 38, 1932.

[3]Carbon Monoxide Distribution in Relation to the Heating and Ventilation of a One-Floor Garage, by F. C. Houghten and Paul McDermott. A. S. H. V. E. JOURNAL (*Heating, Piping and Air Conditioning*), July 1933, p. 376.

[4]Carbon Monoxide Surveys of Two Garages, by A. H. Sluss, E. K. Campbell and Louis M. Farber. A. S. H. V. E. JOURNAL (*Heating, Piping and Air Conditioning*), December, 1933, p. 626.

[5]The Pyrotannic Acid Method for the Quantitative Determination of Carbon Monoxide in Blood and Air, by R. R. Sayers, W. P. Yant and G. W. Jones. Report of Investigations, Serial No. 2486, Bureau of Mines, June, 1923, 6 pp.; Technical Paper 373, Bureau of Mines, 1925, 18 pp.

[6]The Determination of Carbon Monoxide in Air Contaminated with Motor Exhaust, by M. C. Teague. *JOURNAL INDUSTRIAL AND ENGINEERING CHEMISTRY*, Vol. 12, 1920, p. 964.

[7]U. S. Bureau of Mines Technical Paper, 355, by Katz, Reynolds, Frevert and Bloomfield (1926).

Presented at the 41st Annual Meeting of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Buffalo, N. Y., January, 1935.

oxidation of the carbon monoxide in the air is indicated directly in parts of carbon monoxide per 10,000 parts of air by a small millivolt meter, *G*, the pointer of which closes a relay circuit, *H*, when the concentration reaches any predetermined value at which the alarm is set. In its present form the instrument is intended more as an alarm than as a piece of control equipment, and as a result, it is so designed that when the concentration reaches

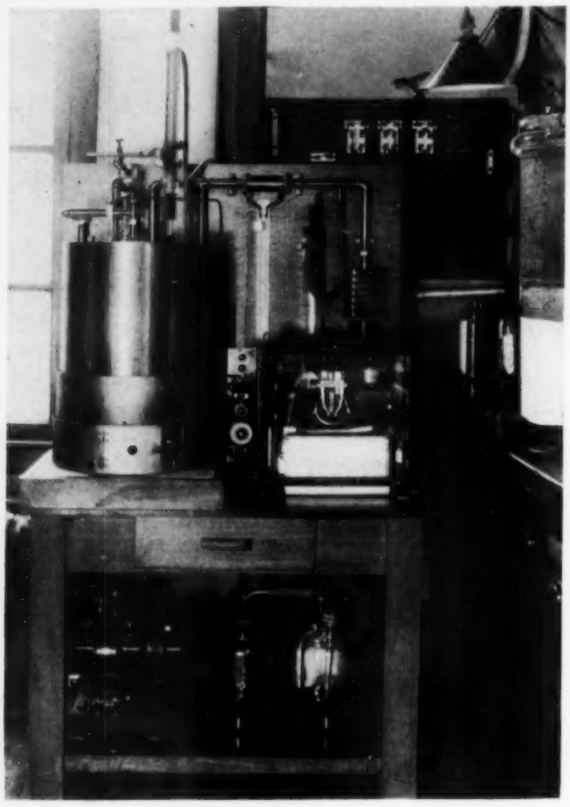


Fig. 1 — U. S. Bureau of Mines carbon monoxide recorder

the predetermined value and the bell starts ringing the circuit continues to be held closed by an electro-magnet until released by an attendant. Hence, in order to use the instrument in its present form as a control, it was necessary to develop a means for automatically releasing the contact at regular intervals of time so that, when the ventilating system, started by the control, had lowered the carbon monoxide content to within safe limits, the fans would be stopped. This was accomplished in the instrument used by the Laboratory by an electric circuit closed at one minute intervals, acting through a solenoid upon the pointer so as to release it. In an instrument especially built for automatic control purposes, this feature can probably be better incorporated in the design of the instrument itself.

The arrangement of apparatus is shown in Fig. 4. The study was made in the two rooms formerly used by the Research Laboratory for investigating solar radiation through windows. A small kerosene engine was located in one of the rooms. The exhaust was so arranged that the gases could be directed to the outside or into the room, or divided between the two in any proportion by valve adjustment. For convenience of the attendant in making the necessary observations, the alarm was placed in the adjacent room, with the intake extended through the wall and into the room containing the engine. Means were provided for quickly taking a 250-cc sample of the air for analysis in order to check the accuracy of the indicator on the alarm and the point at which the alarm or control acted. The room to be ventilated was provided with two openings in the window, in one of which a small desk fan was placed to exhaust air. This fan was usually kept in operation and produced insufficient ventilation with a given rate of exhaust supply to the room to keep the carbon monoxide content of the air within safe limits, and as a result the carbon monoxide content would rise considerably above two parts, unless additional ventilation was provided. The second and larger fan was placed in the second opening in the window and supplied air to the test room at a rate sufficient to bring the carbon monoxide concentration down to one part or lower in about three minutes. This fan was operated by the control acting through a relay, so that as soon as the carbon monoxide reached the limiting value and closed the alarm circuit the fan was started and quickly brought the carbon monoxide concentration in the test room below the limiting value.

The instrument is designed to close the alarm or control circuit at approximately two parts of carbon monoxide in 10,000 parts of air. It does not have sufficient sensitivity to operate successfully and with sufficient reliability at a lower concentration.

Fig. 2 — The carbon monoxide alarm and ventilation control in operation with provision for sampling the entering air

The alarm and control was used in this set-up over a period of 30 days, during which time over 50 samples of the air entering the instrument were collected and analyzed. The procedure in most of the tests was as follows: After the engine and automatically controlled ventilating system had been in operation for two or three hours and everything was operating smoothly, a sample of air was taken when the indicator on the alarm showed about 1½ parts of carbon monoxide in 10,000 parts of air. Another sample was taken when the indicator

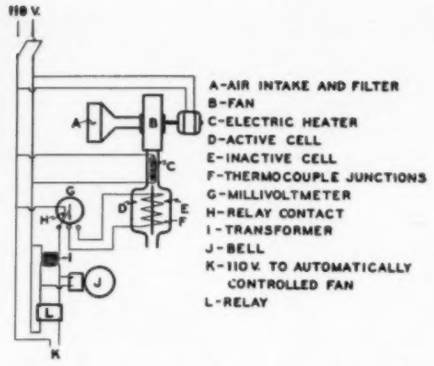


Fig. 3—Diagrammatic sketch of carbon monoxide alarm

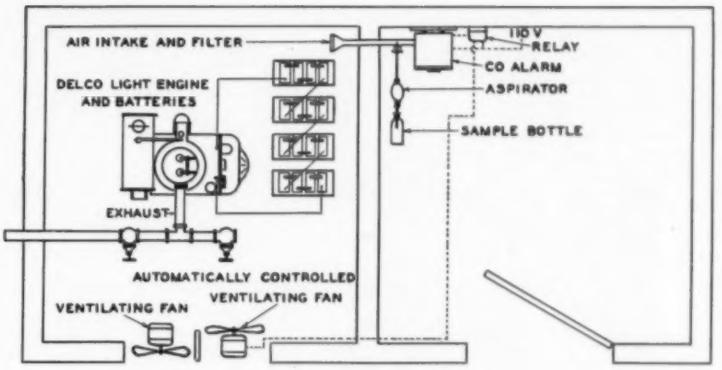


Fig. 4—Diagram of set-up used in studying carbon monoxide alarm

showed a concentration of 2 parts in 10,000, and a third when the concentration was a little higher. These samples were analyzed by the pyrotannic acid method.[5] Since this method of analysis is only sensitive to about ½ of a part of carbon monoxide in 10,000 parts of air, the analysis would only indicate the instrument to be accurate to within these limits, which was considered sufficient for the purpose. For all the samples analyzed, after the test procedure was well established, the indicator on the alarm was shown to be accurate to at least ½ part of carbon monoxide in 10,000 parts of air.

Characteristics and Operation of the Instrument

In operating the instrument the activity of the catalytic agent decreases so that it must be replaced occasionally. Since there is no ready means of determining when a charge of Hopcalite needs replacing, it is desirable to change it at regular intervals sufficiently frequent to insure reliable operation. Recharging at intervals of 14 days has been found sufficient under all practical conditions of operation to insure reliability. The only other attentions required by the instrument are occasional change of the air filter to avoid clogging with dust, and oiling of the motor. Aside from these attentions, the instrument should operate satisfactorily over an indefinite period. After charging the instrument with Hopcalite or after starting it up following a period of in-operation, it does not give an accurate indication of the carbon monoxide concentration until after a lapse of from 20 to 30 min, or until after the oxidation of the carbon monoxide and the resulting rise in temperature have reached equilibrium.

[5]The Pyrotannic Acid Method for the Quantitative Determination of Carbon Monoxide in Blood and Air, by R. R. Sayers, W. P. Yant and G. W. Jones. Report of Investigations, Serial No. 2486, Bureau of Mines, June, 1923, 6 pp.; Technical Paper 373, Bureau of Mines, 1925, 18 pp.

Air Conditioning and Ozone

In an effort to cover the subject of air conditioning so that the engineer or student as well as the public in general may be able to acquaint themselves with the essential facts about this fascinating matter, E. W. Riesbeck has prepared a 352 page volume, entitled Air Conditioning With Ozone Facts, which has been published by the Goodheart-Willcox Company, Inc., Chicago, Ill.

The air conditioning section contains 23 chapters of 252 pages, and ozone is treated in six chapters of 100 pages. The volume is written in non-technical language and is intended to furnish information to those engaged in air conditioning work, with facts and figures taken from practical experience.

The author also presents material on related subjects such as refrigeration and cold storage plant operation. The volume opens with a discussion of the air we breathe and general information on air conditioning and humidity, then discusses ice cooling and conditioning units, central station plants, touches refrigeration briefly and also describes industrial and comfort installations of various types.

Care of equipment, operating troubles encountered and the instruments used are commented upon. It is evident that the data have been taken from a variety of sources but their value would be greatly enhanced if acknowledgment were made to the original sources from which the compiler took them.

Commission of Russian Sanitation

On February 24, 1935, a commission of sanitary engineers from the U.S.S.R. arrived in this country. This commission consists of A. A. Lavenek, manager of the Sanitation Equipment Trust of the U.S.S.R. and the editor of the Russian publication *Heating and Ventilation*, N. A. Tzyper, Assistant Chief Engineer of the Sanitation Equipment Trust and I. A. Andreev, manager of the Sanitation Equipment Repair Works.

They are planning to stay in this country for several months and intend to study American methods of heating, ventilation, air-conditioning and the sanitary equipment of industrial and residential buildings. They will also consider purchasing American machinery and instruments used in connection with sanitation of buildings, and upon their return to the U.S.S.R. make a report to the N.C.T.P. on American equipment.

The commission intends to stay in New York City for two or three weeks and then make an extensive tour of the country. They intend to visit scientific and professional organizations, connected with mechanical and sanitation work, manufacturers of equipment, notable installations in industrial plants, and city buildings, and study the methods of installation of that equipment.

On February 26 in company with M. Markeloff the Commission visited the headquarters office of the A.S.H.V.E. and extended formal greetings to Secy. A. V. Hutchinson and expressed their interest in the operation of the Society.

Pittsburgh Experiment Station of the U. S. Bureau of Mines where the Research Laboratory of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS is located

Report of the Committee on Research for 1934

By **John Howatt*** **and F. C. Houghten†**

THE Committee on Research of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS held three meetings during the year, each attended by a large percentage of the members. At the organization meeting in February Mr. John Howatt, Chicago, Ill., was elected to serve as Chairman. A budget for the year was adopted and other items of business pertaining to adjustment of finances were transacted. A program of research for the year was also discussed and approved. Another meeting of the Committee was held in June during the Semi-Annual Meeting of the Society at Buck Hill Falls, Pa., when the research program was further developed and the activities of the various Technical Advisory Committees were discussed. At this meeting it was planned to publish a new booklet dealing with the society's research activities and its benefit to industry. A committee under the chairmanship of J. H. Walker undertook this work, and an attractive booklet, Research—The Fact Finder, has since been printed and distributed. Another meeting of the Committee as scheduled was held during the 1935 Annual Meeting at Buffalo in January.

The Committee experienced difficulties in developing a budget which could be balanced with the reduced income. Great satisfaction has been felt, however, in the fact that for the first time during the past few years the budget adopted at the beginning of the year has not required further retrenchment. In fact, the Committee was able to meet a number of obligations incurred during former years and still close its books with a better cash balance at the close of this year than has been customary. The 1935 Committee will, therefore, begin the new year without any back log of debts and with a small but comfortable balance in the treasury.

In order to extend the research program possible under the curtailed income, the Committee conceived and put into operation a plan of accepting donations from interested branches of industry to be applied specifically to certain self-liquidating research projects. In this connection a program of research was outlined and undertaken for the *Portland Cement Association* to determine the heat transfer coefficients for different types of concrete wall construction. Eighteen hundred dollars was pledged for this work, which is being carried on at the University of Minnesota in cooperation with the Committee. Plans for a research program were developed dealing with the problem of corrosion of copper and copper bearing alloys used in the heating industry, and the various branches of the industry were invited to participate; however, this plan has not materialized to date.

Besides carrying on a comprehensive research program, the Committee was able to cooperate in other Society work by furnishing some text material for THE GUIDE, 1935, in releasing the services of J. L. Blackshaw, a member of the Laboratory staff, to the Guide Publication Committee, and in handling a limited amount of technical correspondence received at the Headquarters Office of the Society.

A creditable exhibit of the activities of the Research Laboratory and the cooperating universities was prepared and shown at the Heating and Ventilating Show held at the time of the Annual Meeting in New York, and a less comprehensive exhibit was

*Chairman, A.S.H.V.E. Committee on Research; and, Chief Engr. of the Board of Education, City of Chicago, Ill.
†Director, A.S.H.V.E. Research Laboratory, Pittsburgh, Pa.
Presented at the 41st Annual Meeting of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, Buffalo, N. Y., January, 1935.

displayed at the annual convention of the *American Oil Burner Association* in Philadelphia and some panels depicting the Research were on display at the Power Show in New York.

BUDGET 1934

INCOME	Budget 1934	Actual 1934
Balance from preceding year	$ 1,741.65	.....
A. S. H. V. E. Dues and Guide	8,000.00	$ 8,428.69
Contributions:		
Associations, Manufacturers and others	3,500.00	4,772.00
Exposition	3,000.00	3,770.31
Interest on Bank Balance	10.00	.....
Interest on Research Securities	135.00	90.00
Interest on Society Endowments	575.00	575.92
Due from previous year's operations:		
(a) Contributions	425.00	275.00
	$17,386.65	$17,911.92
EXPENSES		
Travel—Committee and Laboratory Personnel	$ 1,200.00	$ 819.96
Salary—Technical Adviser (Back Salary)	2,000.00	2,000.00
General Printing and Promotion	400.00	324.13
Correlating Thermal Research	500.00	500.00
A. S. H. V. E. Laboratory at Pittsburgh:		
Salaries	7,620.00	6,869.95
Laboratory Supplies and Equipment	500.00	481.57
Office Supplies and Equipment	350.00	261.23
Meetings, Exhibits, etc	350.00	304.31
Contracts with Cooperating Institutions	3,705.00	4,455.00
Contingency Fund (For use as directed by the Committee)	761.65	85.00
	$17,386.65	$16,101.15

1934 Research Contributors

Aerofin Corp.
Allegheny County Steam Heating Co.
American Architect.
American Radiator and Standard Sanitary Corp.
Barber-Colman Co.
Buffalo Forge Co.
Bush Manufacturing Co.
Carrier Engineering Corp.
Crane Co.
Duquesne Light Co.
General Electric Co.
General Motors Co., Frigidaire Div.
Grant Bldg., Inc.
Hoffman Specialty Co.
Ilg Electric Ventilating Co.
International Exposition Co.
International Union of Operating Engineers.
Johns-Manville Corp.
Johnson Service Co.
Kewanee Boiler Co.
Kinetic Chemicals Co.
Mine Safety Appliances Co.
Modern Building Insulation Co.
Minneapolis-Honeywell Regulator Co.
Mueller Brass Co.
Nash Engineering Co.
National Regulator Co.
National Warm Air Heating and Air Conditioning Assn.
Herman Nelson Co.
J. J. Nesbitt, Inc.
New York Blower Co.
Pittsburgh Meter Co.
Portland Cement Assn.
B. F. Sturtevant Co.
Trane Co.
United Engineers and Constructors, Inc.
Utilities Research Commission, Inc.
Westinghouse Elec. & Mfg. Co.
York Ice Machinery Corp.
Young Radiator Co.

Research Activities During 1934

During the year 1934 the Committee on Research gave consideration to 16 research projects, each of which was considered by a Technical Advisory Committee. In some cases the work of the committees resulted in improvement or standardization of available data, while in other cases the committees developed a program of research to be carried out whenever the necessary funds and facilities are available. Because of the budget limitations, both for the work at Pittsburgh and in cooperating Universities, actual investigation was limited to a few of these projects. In some instances only a small amount of time could be given to a subject, with the result that solution of the problems considered by the Committee on Research has progressed slowly. Nevertheless, the Technical Advisory Committees were of great service in cooperating with the Chairman of the Committee on Research and the Director of the Laboratory in developing plans for carrying on the studies made. The organization of the various Technical Advisory Committees brought the combined experience and abilities of 94 engineers, educators and scientists into cooperation for the advancement of fundamental knowledge. Dr. A. C. Willard, president of the University of Illinois, continued as Technical Adviser to the Committee.

Cooperating Universities

The practice of extending the work carried on under the Committee's direction by cooperation with engineering departments of universities was continued. It is particularly gratifying to note that while the Committee has had to cease contributing financially toward many of these studies, the interest of the institutions has been retained, and in almost every instance active work has been continued. The following institutions have had active cooperative agreements with the Committee on Research during the year, under which definite projects have been investigated:

1. UNIVERSITY OF MINNESOTA: (1) Dust and dust control apparatus. (2) Heat transmission.
2. UNIVERSITY OF ILLINOIS: (1) Direct and indirect radiation with gravity air circulation. (2) Cooling of buildings in summer.
3. HARVARD SCHOOL OF PUBLIC HEALTH: (1) Minimum air requirements for ventilation.
4. UNIVERSITY OF WISCONSIN: (1) Heating of buildings.
5. AGRICULTURAL & MECHANICAL COLLEGE OF TEXAS: (1) Insulation of buildings.
6. MICHIGAN COLLEGE OF MINING & TECHNOLOGY: (1) Corrosion in return lines in relation to the chemical composition of the water, vapor, and gas handled.
7. CASE SCHOOL OF APPLIED SCIENCE: (1) Heat transfer from direct and extended surfaces with forced air circulation.
8. YALE UNIVERSITY: (1) Oil burning equipment used in heating.
9. MARQUETTE UNIVERSITY: (1) Methods of air supply and distribution in air conditioning.

Papers Resulting from 1934 Research

The Committee on Research, through its Technical Advisory Committees, succeeded in bringing its studies to a sufficient stage of completion to result in 14 technical papers for presentation before the Society and publication in the 1934 and 1935 issues of the A.S.H.V.E. JOURNAL (in *Heating, Piping and Air Conditioning*), as follows:

1. Corrosion Studies in Steam Heating Systems, by R. R. Seeber, F. A. Rohrman and G. E. Smedberg, March, 1934.
2. Study of Fuel Burning Rates and Power Requirements of Oil Burners in Relation to Excess Air, by L. E. Seeley and E. J. Tavanlar, May, 1934.
3. Insulating Value of Bright Metallic Surfaces, by F. B. Rowley, June, 1934.
4. Heat Transfer from Direct and Extended Surfaces with Forced Air Circulation, by G. L. Tuve and C. A. McKeeman; June, 1934.

5. Factors Affecting the Heat Output of Convectors, by A. P. Kratz, M. K. Fahnestock and E. L. Broderick; July, 1934.
6. Influence of Stack Effect on the Heat Loss in Tall Buildings, by Axel Marin; August, 1934.
7. Wind Velocities Near a Building and Their Effect on Heat Loss, by F. C. Houghten, J. L. Blackshaw and Carl Gutberlet; September, 1934.
8. Tests of Three Heating Systems in an Industrial Type of Building, by G. L. Larson, D. W. Nelson and John James; November, 1934.
9. Study of Unit Room Coolers in the Research Residence, by A. P. Kratz, M. K. Fahnestock and S. Konzo; November, 1934.
10. The Heat Requirements of Buildings, by J. H. Walker and G. H. Tuttle; December, 1934.
11. Cooling Requirements of Single Rooms in a Modern Office Building, by F. C. Houghten and Carl Gutberlet. Presented at the Annual Meeting, January, 1935.
12. A Laboratory Study of Minimum Ventilation Requirements: Ventilation Box Experiments, by W. H. Lehmberg, A. D. Brandt, and Kenneth Morse; January, 1935.
13. Study of Summer Cooling in the Research Residence for the Summer of 1934, by A. P. Kratz, S. Konzo, M. K. Fahnestock and E. L. Broderick; January, 1935.
14. A Carbon Monoxide Alarm and Ventilation Control, by F. C. Houghten and Linwood Thiessen; March, 1935.

Research Projects Investigated During 1934

The personnel of each of the 16 Technical Advisory Committees working with the Committee on Research are listed below, with a report of their year's activity:

1. HEAT REQUIREMENTS OF BUILDINGS

D. S. Boyden, *Chairman*	V. W. Hunter
P. D. Close	E. C. Rack
W. H. Driscoll	F. B. Rowley
H. M. Hart	R. J. J. Tennant
P. E. Holcombe	J. H. Walker

The Committee on Heat Requirements of Buildings, appointed in November 1933, realized that it confronted a very difficult task, the solution of which has baffled heating engineers since the beginning of the profession. The committee proceeded to analyze current practices for estimating heating requirements of buildings and developed plans for attack on the problem from a number of points of view.

Analyses of Current Practices

The analyses of current practices indicated clearly that use of the more accurate heat transfer and infiltration coefficients developed by the Laboratory and cooperating universities during the past few years resulted in an unwarranted increase in installed heating capacity in modern buildings. This fact indicates a need of correcting assumptions regarding basic outside temperatures and wind velocities and their effect on heat loss from buildings. It also appeared desirable to further consider such factors as heat capacity of the building, sources of heat within the building, and solar radiation effects.

The analysis of the relative effect of outside temperatures and wind velocities on heat requirements made by the *Heating, Piping and Air Conditioning Contractors National Association* some years ago was considered. While the careful consideration given by them to the effect of concurrent low outside temperatures and wind velocities seemed entirely logical, their practice of allowing one degree fall in temperature as equivalent to one mile of wind velocity could not be accepted as a scientific solution of the problem.

An analysis of present GUIDE methods of calculating heating requirements indicates that too much consideration is given to the effect of wind velocities. THE GUIDE practice recommended at the time the Committee began its study based all calculations for all sides of a building on a 15-mph wind velocity and then added an additional 15 per cent for the heat loss from the two exposed sides. Consideration of this question has resulted in elimination of the 15 per cent exposure factor for exposed sides in the recommended practice given in THE 1934 GUIDE since published.

Research Carried on by the Committee

Prof. Axel Marin of the University of Michigan, in cooperation with the Detroit Edison Co. and the Committee, made a study of the heat loss from rooms at different elevations in the Penobscot Building in Detroit, Mich., and presented a paper[6] on the subject at the Semi-Annual Meeting of the Society. This paper indicated a progressive decrease in heat loss with increased elevation in the building.

P. D. Close, Chicago, Ill., made an analysis of the relation between prevailing low temperatures and wind direction and velocities, resulting in the paper, Selecting Temperatures and Wind Velocities for Calculating Heat Losses, presented at the 1934 Annual Meeting of the Society. This paper adds much to the knowledge of probable combinations of low temperatures and high wind velocities resulting in maximum heat requirement.

The Research Laboratory at Pittsburgh collected data during the last heating season on the heating requirements of eight rooms at different elevations having different exposures in the Grant Building, a modern office building of the sky-scraper type in Pittsburgh. The results of this study were partially analyzed with a view of determining the relationships between wind velocities prevailing in close proximity to different exposures and elevations of the building to those reported by the Weather Bureau for the city. A paper[7] dealing with this phase of the subject was presented at the Semi-Annual Meeting of the Society, which indicates that the wind velocities against any particular exposure of the building cannot be predicted from Weather Bureau reports. Also, contrary to accepted practice in estimating heating requirements, the maximum velocities were not observed at high altitudes above surrounding buildings, but rather around the lower part of the building, where wind was confined between the buildings on the two sides of streets. The Laboratory is now proceeding with the analysis of the rest of the data collected last winter which should add something to our information on the relation of the required heating load to outside weather conditions.

J. H. Walker and G. H. Tuttle, Detroit, Mich., analysed data on steam consumption in relation to types of buildings and occupancy, outside weather conditions and other factors, for 163 buildings in 22 different cities. The analysis was made as a contribution to the work of this committee resulting from data collected for the *National District Heating Association*. Quoting from the Summary of the paper,[10] The Heat Requirements of Buildings, presented at the Annual Meeting of the Society:

"The paper gives the heat consumption of a large number of buildings on a degree-day basis and recommends, as a unit for comparison, the heat consumption per degree-day per thousand Btu of calculated heat loss.

"The maximum demands and load factors are given for different kinds of buildings. That the maximum demand and heat consumption are affected by other variables than temperature alone is demonstrated by typical load curves from a district heating system.

"Data on the hot water consumption of various kinds of buildings are included."

The Committee has plans for additional studies of the relation between low temperatures and wind velocities as reported by Weather Bureau stations for different cities, in order that better assumptions may be made for the worst prevailing conditions for heating in any locality.

The Committee has also outlined a study of the heating requirements of Sibley Dome, one of the University of Cornell Buildings in Ithaca, N. Y. This building was chosen for the reason that it was a modern university building with fairly constant daily occupancy. The following data will be collected during the coming heating season: a record of the rate of steam consumption; temperatures throughout the heating space; outside weather conditions, including temperature and wind velocity. The wide variations in temperature, together with the wide variations in wind velocity experienced during the heating season in Ithaca, suggest that this study should add much to knowledge of the variation in heat loss from a building with varying outside temperatures and wind velocities.

Studies of heat losses from buildings will be made at the University of Minnesota, University of Wisconsin and University of Illinois. The Research Laboratory is making a parallel study of cooling requirements of three offices in the Grant Building in

[6,7,10] See List of Research Papers.

Pittsburgh, a report[11] of which was presented at the Annual Meeting of the Society. J. H. Walker has contributed a paper which will present a summary of the information which district heating companies have compiled on the load characteristics and annual steam requirements of various types of buildings, and will show steam consumption per degree day for various types of buildings, hourly demands, and water heating requirements.

Plans have been perfected for a study by Prof. F. B. Rowley of the University of Minnesota of variation in conductivity of concrete of various mix and aggregate.

Deductions from the Committee's Studies

The studies made during the year by the Committee indicate clearly that current methods for estimating heating requirements need revision, with probably the most serious errors in present methods resulting from improper consideration to the combined effect of concurrent low temperatures and high wind velocities. Basic outside conditions as pertaining to low temperatures and concurrent wind velocities must ultimately be based upon individual analysis for each city or locality similar to that made some years ago by the *Heating, Piping and Air Conditioning Contractors National Association*, and that suggested by Mr. Close in his recent paper. The Committee considers it too early, however, to base a final conclusion on the evidence at hand at this time. There is some evidence available resulting from the studies of the Research Laboratory and elsewhere which tends to indicate that wind velocities and directions reported by the Weather Bureau had little bearing on those prevailing in close proximity to buildings. If these indications are substantiated by further work, it is possible that a solution based upon Weather Bureau figures alone may be as much in error as present methods.

Other factors which appear to affect the heat loss from buildings are the heat capacity of the building, the elevation of individual rooms within the building and sun effects.

While the Committee feels that its studies to date do not warrant a final conclusive report solving the problems presented to it, it does feel that through analyses of present methods and research, marked progress has been made toward the solution, and that continued study of the subject along present lines will bring ideal solution of the problem progressively closer.

2. VENTILATION OF GARAGES AND BUS TERMINALS

E. K. Campbell, *Chairman*

S. H. Downs
T. M. Dugan
E. C. Evans
F. H. Hecht
H. L. Moore
A. H. Sluss

The objective of the Technical Advisory Committee over the past few years has been the development of a code for the ventilation of garages. In early attempts to prepare such a code the committee was confronted with the need for additional technical data particularly pertaining to elimination of carbon monoxide. Hence, the committee has included in its program research carried on by the Laboratory in Pittsburgh and by the University of Kansas in Kansas City and Lawrence, Kans. in cooperation with the Society.

The studies made at Pittsburgh and by the University of Kansas have been rather conclusive and demonstrative that in a ramp garage where there is considerable mixing of exhaust gases through the building, sufficient air must be supplied to dilute the exhaust gases to the point where the concentration of carbon monoxide contained therein is diluted to safe limits, or approximately one part of carbon monoxide in 10,000 parts of air. The studies made in single floor garages indicate that much can be accomplished by supplying outside air and exhausting vitiated air in such a manner as to eliminate the exhaust gases from the building before they have had an opportunity to mix with all of the air in the garage.

Because of the tremendous amount of air necessary for ventilating garages, a keen desire has been experienced for some instrument which could indicate and act as an alarm when the carbon monoxide concentration approaches a dangerous condition; or better yet, an instrument which can be used to control the operation of the ventilation equipment so as to keep the carbon monoxide concentration within safe limits. Largely through the need expressed by the work carried on under this committee and the encouragement given by the committee and the Laboratory in Pittsburgh, the Mine Safety Appliances Co. of Pittsburgh, holding the fundamental patents on which the Bureau of Mines carbon monoxide recorder is based, has been induced to develop an instrument suitable for use in garages. This instrument has been studied by the Laboratory in Pittsburgh in order to demonstrate its practicability in garage ventilation and with a view of adopting it as an instrument to control garage ventilation. As hoped for this study was completed in time for the presentation of a paper[14] on the study to the Society at the 1935 Annual Meeting.

The committee is continuing to work on the development of a code for the ventilation of garages.

3. SOUND IN RELATION TO HEATING AND VENTILATION

V. O. Knudsen, *Chairman*

C. M. Ashley
C. A. Booth
F. C. McIntosh
R. F. Norris
J. S. Parkinson
C. H. Randolph
J. P. Reis
G. T. Stanton

The committee has undertaken three projects which seem to be of most importance in relation to the acoustical problems which arise in the heating and ventilating of buildings.

1. J. S. Parkinson of Johns-Manville Co. is undertaking an investigation of the transmission of sound through ventilating ducts, with the specific purpose of determining quantitative data which can be used in calculating the effective sound reduction accomplished by different kinds of ducts, lined with different types of absorptive material, or including different types of sound filters.

2. C. M. Ashley of Carrier Engineering Corp. is undertaking an investigation to determine the noise rating of different types of machines used in the heating and ventilating of buildings.

3. Data are being collected on the amount of noise which can be tolerated without discomfort or objection, in different types of buildings. The acoustical engineers of the Electrical Research Products, Inc., have many men in the field equipped with facilities for making these measurements, and it is hoped that within a year or so, tolerance limits can be established for different buildings.

When the amount of noise which different machines generate is known, and when the amount of noise which can be tolerated in different kinds of buildings is also known, it is then possible to specify just how much sound insulation or sound absorption must be provided to meet any specified guarantee of noise.

The committee will welcome suggestions with regard to any of the above mentioned, or other, projects.

4. AIR CONDITIONS AND THEIR RELATION TO LIVING COMFORT

C. P. Yaglou, *Chairman*
W. L. Fleisher
D. E. French
J. J. Aeberly
R. R. Sayers
C.-E. A. Winslow

The cooperative study between the Society and Harvard School of Public Health on minimum air requirements for ventilation was continued during the year. An outline of this work appeared in the annual report of the committee for 1933, and the results of preliminary research have been presented[12] at the Annual Meeting. The work is scheduled for completion during next summer, and the final report will be presented at the following Annual Meeting.

Other suggestions considered by the Committee for future research are numerous. However, it would seem that the Society should study or perhaps undertake research on the following three fundamental questions which are given in order of importance.

1. The effects of prolonged exposure to low concentrations of CO_2 (0.06 to 0.20 per cent) from a consideration of possible respiratory and metabolic changes and changes in the pH of the blood.

2. The influence of relative humidity on the water balance of the tissues of the organism, nerve sensibility, irritability, etc.

3. Physical and physiological action of ozone in concentrations near and below the olfactory threshold.

[11] See List of Research Papers.

[12,14] See List of Research Papers.

A critical review of the literature on each of the subjects by members of the committee will indicate where information is inadequate and what additional research is needed.

5. DIRECT AND INDIRECT RADIATION WITH GRAVITY AIR CIRCULATION

H. F. Hutzel, *Chairman*
A. P. Kratz
H. R. Linn
J. F. McIntire
J. P. Magos
T. A. Novotney
R. N. Trane
G. L. Tuve

Plans for the investigation of direct radiators and convectors have been completed and research has proceeded at the University of Illinois along the same lines as previously adopted, with tests in both the room heating testing plant and the warm-wall testing booth. The work has been limited due to the drastic reduction in the budget.

Tests with one type of non-ferrous convector, and the eupatheoscope, were made in the room heating testing plant to determine the effect of varying the relative humidity of the air upon the heat output. The relative humidity of the air during the tests made with the convector was varied from 6 to 68 per cent, and, although there was a slight tendency for the heat output to decrease as the relative humidity of the air was increased, the decrease with the relative humidity of the air at 68 per cent did not exceed one per cent of the heat output obtained with relative humidities of from 6 to 15 per cent. No appreciable change in the heat loss from the eupatheoscope occurred when the relative humidity of the air was varied over a range from 25 to 80 per cent.

The tests in the warm wall booth were continued for the purpose of consolidating all of the results previously obtained, and determining whether the heat outputs of all of the types of convectors tested could be represented by an equation of the form, $H = K\ (t_s - t_1)^n$; and whether some exponent, n, differing from 1.3 would be more representative of all of the types of convectors tested. The results of tests made with 24 convectors, consisting of seven different types, lead to the conclusion that the error resulting from the use of the exponent 1.5 in the correction factor is less than that resulting from the use of an exponent of 1.3 as now recommended in the A.S.H.V.E. Standard Code for Testing and Rating Concealed Gravity Type Radiation (Steam Code).

The results were presented at the Semi-Annual meeting of the Society in a paper[2] published in the JOURNAL of the Society.

The work in the room heating testing plant now consists of:

(a) Effect of height of enclosure on heating effect;
(b) Effect of top outlets on heating effect; and
(c) Effect of recessing on heating effect and heat output.

The work in the warm wall booth consists of a study of the optimum inlet and outlet dimensions in relation to the free area through the heating unit, the gross cross-sectional area of the cabinet, and the cabinet height.

6. OIL BURNING DEVICES

H. F. Tapp, *Chairman*
Elliott Harrington
F. B. Howell
J. H. McIlvaine
L. E. Seeley
T. H. Smoot

The investigation of the plans outlined for studies of oil burners at Yale University, in cooperation with the *American Oil Burner Association* and the Society, was dormant during the year because of lack of funds. A paper[3] resulting from earlier studies was presented at the Annual Meeting.

7. PIPE AND TUBING (SIZES) CARRYING LOW PRESSURE STEAM OR HOT WATER

S. R. Lewis, *Chairman*

J. C. Fitts
F. E. Giesecke
H. M. Hart
C. A. Hill
R. R. Seeber
W. K. Simpson

The major work originally charged to this committee was completed in the laboratory studies made in Pittsburgh and reported some time ago. These studies gave rather complete information on all the doubtful questions on flow of steam in pipe to which the committee gave consideration. The only additional work which the committee has in mind at present is the analysis of the various laboratory reports and the preparation of a final correlating report clearly setting forth recommendations for changes in pipe sizes resulting from the laboratory studies. A reduction in personnel of the Laboratory staff and the urge for other work has delayed completion of this study.

8. CORRELATING THERMAL RESEARCH

R. M. Conner, *Chairman*

D. S. Boyden
J. C. Fitts
H. T. Richardson
Perry West

Plans for the correlation of research in industry, sponsored initially by S. R. Lewis, Chicago, Ill., as far back as 1927, have been continued to date. Although the original purposes of this activity have not been lost sight of, the work during the past few years has been on a rather restricted basis due to shortage of funds.

During the past year the cross-index card catalog file dealing particularly with thermal engineering subjects, has been maintained at the Society's Research Laboratory in Pittsburgh. Although this work has been financed on a greatly reduced basis, the various files have been maintained in satisfactory shape, and a great deal of useful information has been compiled for the benefit of anyone interested in thermal engineering subjects.

Lack of funds made it necessary for the committee to forego its plans for publishing a Directory this year. It is planned, however, to bring out the 1935 Directory of thermal research projects, and institutions participating in such work, prior to the expiration of the present school year. The committee feels that a very useful purpose can be served by placing at the disposal of interested trade associations and other scientific organizations this directory, showing the class of experimental work that is going on. It is believed that the proper use of such a publication should avoid useless duplication of effort and also assist in promoting more friendly relations and a better understanding among the various societies, associations, and other organizations comprising this branch of the industry. It is the committee's sincere belief that the objectives originally laid down and which have been followed so diligently during the past few years, should be continued to the end that useless duplication of effort in research, codification and standardization may be avoided and the best interests of the profession and of industry in general be served.

9. HEAT TRANSFER OF FINNED TUBES WITH FORCED AIR CIRCULATION

F. B. Rowley, *Chairman*

H. F. Bain
H. F. Hutzel
W. G. King
A. P. Kratz
E. J. Lindseth
L. P. Saunders
G. L. Tuve
W. E. Stark

At the June meeting of the Society, Professor Tuve and Professor McKeeman presented a paper[4] covering the important results of the study carried on at Case School of Applied Science in cooperation with the Research Laboratory. Arrangements have since been made whereby the Mechanical Engineering Laboratory at Case School will provide certain equipment and time for continuing the work. Due to financial limitations, however, only a very modest rate of progress will be possible.

The above paper included the following:

1. A study of the methods for calculating the heat transfer of fin-tubing.
2. Results of experimental work on one type of fin-tubing, in which the effects of air velocity and of turbulence in the air stream were determined.
3. Correlation of these results with those from previous investigations, both American and European, with a table giving a summary of proposed methods for calculating the heating and cooling of air by forced convection.

Aside from air velocity and turbulence, the main factor affecting the heat transfer coefficient is the design of the fin-tube. Accordingly, there is now being constructed a new experimental unit for conveniently testing several kinds of fin tubes. The arrangement will be similar to the unit previously studied with draw-through air flow, but the working section will be 16 in. square (instead of 35) and the heat input will be from a specially

[2,3] See List of Research Papers.

[4] See List of Research Papers.

constructed electric boiler, with recirculation of the condensate. The input will therefore be measured electrically. One of the main features will be easy interchange of the test sections.

The committee is attempting to obtain a number of sets of samples of fin-tubing, so that the study may be extended to as many variations in design-proportions as possible. The work will be confined to a single bank of tubes for the present and therefore if twelve tubes of each design could be obtained, test sections could be constructed. The tubes will be mounted vertically, in parallel, with distributing orifices in the intake manifold. Tests will be made over a range of at least 500 to 1,500 fpm linear air velocity through the free area. Possibly, manufacturers would be willing to loan completed test sections of this size (16 in. square area of fins).

With this set-up there will be investigated the variables of: (1) fin spacings per inch, (2) fin thickness, (3) fin height, (4) tube diameter, and (5) type of fin and fin attachment. If the test sections are obtained without too much delay, it should be possible to produce a reasonable amount of good data in time for presentation at the 1935 June meeting. These results should be applicable with fair accuracy to a wide variety of types of extended surface units, and should therefore be of considerable value to designers in the heating and air conditioning fields.

10. REFRIGERATION IN RELATION TO AIR TREATMENT

A. P. Kratz, *Chairman*
E. A. Brandt
John Everetts, Jr.
E. D. Milener
K. W. Miller
E. B. Newill
F. G. Sedgwick
J. H. Walker

The work in summer cooling as finally outlined by the committee involved the use of a two-ton mechanical refrigerating unit in connection with the forced air heating system employed for winter heating. For part of the season the artificial cooling in the daytime was supplemented by cooling with outdoor air at night. The outdoor air was circulated by means of the fan in the forced air system and the second story windows only were opened at night. For part of the season the windows were not opened and the artificial cooling was not supplemented by cooling with outdoor air at night. The machine had a constant output and the amount of cooling was controlled by *on* and *off* operation of the compressor to maintain a constant temperature of approximately 80 F in the house. Over the entire period requiring artificial cooling the fan was operated during both the *on* and *off* periods of the machine, and auxiliary outdoor air equivalent to approximately one air change per hour was taken into the house for the purpose of ventilation. Some tests were run with night cooling alone, in which case the air from outdoors was circulated by means of the fan in the forced air system and the second story windows only were opened.

The results of the summer's work indicated that in milder weather some saving was effected by supplementing the artificial cooling with night air cooling. In severe weather, however, the nights did not cool sufficiently to render such supplementary cooling effective. Night cooling with the fan in the forced air heating system circulating approximately nine air recirculations per hour and with the second story windows only opened was not nearly as effective as it was when the attic fan was used under the same conditions drawing in approximately 36 air changes per hour through the second story windows. The machine actually developed approximately 2½ tons of refrigeration and this was sufficient to maintain 80 F in the house even in the hottest weather. While the number of degree hours above 85 F for the season was about normal, the summer was unusually severe in that there was a high concentration of days having maximum temperatures exceeding 90 F. The results were presented in a paper[13] at the Annual Meeting of the Society. The *National Warm Air Heating and Air Conditioning Association*, and the *Utilities Research Commission* of Chicago cooperated in this study.

[13] See List of Research Papers.

11. ATMOSPHERIC DUST AND AIR CLEANING DEVICES

(Including Dust and Smoke)

H. C. Murphy, *Chairman*
J. J. Bloomfield
M. I. Dorfan
Philip Drinker
Leonard Greenburg
S. R. Lewis
T. W. Pangborn
F. B. Rowley
Games Slayter

The Standard Code for Testing and Rating Air Cleaning Devices Used in General Ventilation Work, which was formulated by the committee, was approved by ballot vote of the membership of the Society and adopted at the June meeting. The Code has also been submitted to the *American Standards Association* for acceptance as an Approved Standard with the sponsorship of the Society and approval of a number of engineering societies.

The Committee has in preparation a Code for Testing and Rating Air Cleaning Devices Used in Public Health Work. Considerable study has been devoted to existing procedures in handling hazardous dusts and the Committee hopes to have a tentative Code ready for discussion within the next few months. The formulation of such a Code is becoming increasingly important. Recent court decisions placing the responsibility for various industrial diseases squarely on the employer has resulted in the considerable elimination of dust hazards. The situation is made more acute because of the legal racket which is developing hundreds of suits at common law for injury or death due to silicosis and similar disorders. There are between 1,000 and 1,500 suits in New York State alone asking damages in the aggregate of $50,000,000.00.

At present there are no recognized standards for testing and rating dust arrestance of air cleaning devices used in dust hazardous work. The committee is working earnestly to develop such a Code in view of the commercial importance of the subject. The committee has also cooperated with a number of individuals and associations interested in the control of atmospheric pollution.

12. CORROSION

J. H. Walker, *Chairman*
H. F. Bain
E. L. Chappell
W. H. Driscoll
R. R. Seeber
C. M. Sterne

The committee has had under consideration for the past two years a study of the effects of the chemical characteristics of condensate returning from a steam heating system on corrosion of iron and steel pipe. A program for the study outlined by the committee is being studied by Prof. R. R. Seeber of the Michigan College of Mining and Technology in cooperation with the Laboratory. The study is an unusually tedious one and progress will be made slowly. The committee feels, however, that definite progress toward a final solution is being made. The study to date has resulted in a progress report[1] presented at the last Annual Meeting of the Society.

The committee has also given consideration during the past year to a study of corrosion of copper and copper bearing alloys used in steam heating, ventilating and air conditioning systems. A general program for this study was developed, which it is hoped manufacturers will support.

13. GAS HEATING EQUIPMENT

W. E. Stark, *Chairman*
Robert Harper
E. A. Jones
Thomson King
J. F. McIntire
E. L. Tornquist
H. L. Whitelaw

Work previously outlined by this committe is being continued.

14. AIR CONDITIONING IN TREATMENT OF DISEASES

E. V. Hill, *Chairman*
N. D. Adams
J. J. Aeberly
Margaret Ingels
H. R. Linn
E. L. Stammer

This is a new committee appointed this year to give consideration to a program for possible research dealing with the relation between atmospheric conditions and health, with particular refer-

[1] See List of Research Papers.

ence to the effect of air conditioning in the treatment of diseases. Certain difficulties have arisen in instituting worthwhile investigations on the treatment of disease by air conditioning, due to the indefiniteness of certain terms involved, and to the magnitude of the task as a whole. What is air conditioning? What is treatment? And what diseases are affected by the air environment? To avoid an interminable discussion, let us say that air conditioning is the modification and control of our natural air environment in order to make it more suitable for the uses of mankind. This is a much broader definition than the simple control of temperature, humidity, air motion, and air cleanliness, which is favored from a commercial or engineering standpoint by some members of the Society.

But when we get into the subject of the treatment of disease, it becomes at once apparent that these four primary factors are entirely inadequate. For example, the work of Grollman of Johns Hopkins in the treatment of anemia by varying the air pressures comes clearly within the scope, or at least the possibilities, of air conditioning.

In our letter to the members of the Committee on April 19 we discussed the subject of classification. We stated in that letter that we had discarded the United States Census classification on morbidity and had tentatively adopted Dr. Wm. Osler's classification of disease under eleven different headings. We find, however, upon further study that this leads us into extensive investigations with questionable results, and it appears desirable therefore to throw out all of these accepted classifications of disease and adopt one of our own. We submit the following classification of diseases affected by the air environment:

Internal

1. Animal Parasites
   - —Malaria
   - —Yellow Fever
   - —Malta Fever, Etc.
   - —Bites from flies and insects
2. Respiratory Diseases
   - —Colds
   - —Influenza
   - —Bronchitis
   - —Tuberculosis
   - —Pneumonoconiosis
3. Allergic Diseases
   - —Asthma
   - —Hay Fever

External

4. Thermal Diseases and Disturbance
   - —Sunstroke
   - —Heat Prostration
   - —Cold exposure reactions
   - —The skin temperature and metabolism
5. Air Pressure Reactions
   - —Anemia
   - —Chlorosis

This classification, obviously, does not include a vast number of diseases which are affected by our air environment. For example, recent investigations indicate the possibility that constitutional diseases, heart disease, arteriosclerosis, nephritis, etc., may be very closely related to dust inhalation. The late Dr. Fenton B. Turk, in his investigation of shock and similar phenomena, developed his theory founded on a mass of experimental evidence that autolyzed body cells liberate a substance which he named cytost that is extremely toxic to homologous animals. A small piece of skin from the neck of a cat, for example, digested in sterile water and reinjected into the host will cause its death, in as short a period of time as three minutes. He pointed out that human beings in inclosed spaces are constantly giving off dead cells which in dusty air are breathed, possibly producing in this attenuation tissue changes and grave constitutional disturbances.

If we consider in our research program the obscure effects of recent research of this character the investigation would have no end, even though this work is of the greatest interest and probably of inestimable value to mankind.

In the first division of the suggested classification we have malaria, yellow fever, and other diseases caused by the bite of flies and insects, or by parasites introduced in this manner. We can dismiss these diseases from consideration with the understanding, of course, that they are easily eliminated by that state of air cleanliness which prevents their entrance into habitable rooms.

Under respiratory diseases the Committee will find much to investigate. The last item in this division, the pneumonoconiosis, includes silicosis, cholacosis, etc.; in fact, a large part of present activities in industrial hygiene.

Much work has already been done in the third classification, the Allergic Diseases. We mention only asthma and hay fever, but there are many others and the proper filtration of air has already opened up a valuable field for air conditioning.

Under External Effects we have subdivisions 4 and 5 relating to the reactions of the human body from variations of temperature, humidity, and air motion, and also from variations in air pressure. Research work in this particular field should produce immediate results, and we suggest first that with the new conception of skin temperature as determining human comfort, and with preliminary work already done on this subject by Emma France Ward of Johns Hopkins University, and our own research staff at Pittsburgh, we are now in a position to check effective temperature lines against the skin temperature of human subjects. This should be undertaken without delay.

Reviewing the preceding comments, and particularly the classification of diseases where air conditioning has a very definite therapeutic effect we suggest that work be first undertaken under the fourth classification. This deals with the effect of air temperature, humidity, and motion, on the human body.

One of the members of our committee, N. D. Adams of Rochester, Minnesota, is in close touch with many of the medical and surgical attendants at the Mayo Foundation. Through his intimate acquaintance with these men, many of whom enjoy an international reputation, we have been enabled to discuss some of the physiological and pathological problems involved in this study. Dr. Walter M. Boothby of that institute has made a painstaking study of oxygen therapeutics and has contributed considerable material of great value to the profession from his research work and clinical experience.

Dr. Sheard, Dr. Brown, Dr. Plummer, and others have interested themselves in our research problem and after several visits to the institution by the writer, and the Chairman of the Research Committee, Mr. Howatt, a program was suggested whereby the A.S.H.V.E. Research work could be carried on in this institution, particularly along the lines to be developed in the fourth classification of diseases. The institution is exceptionally well equipped with apparatus of every kind, oxygen rooms, skin temperature devices, etc., and a study here of both the normal and abnormal would be of inestimable value not only to our Society from an engineering standpoint but to the medical profession from a therapeutic standpoint.

15. THE EFFECT OF ENTERING TEMPERATURE AND VELOCITY ON THE TEMPERATURE AND DISTRIBUTION OF AIR WITHIN AN ENCLOSURE

C. H. Randolph, *Chairman*

E. H. Baars
John Jung
F. A. Kartak
J. E. Schoen
Ernest Szekely
J. H. Volk

The objective of this committee is to determine the effect on air distribution and temperature variation within a ventilated space of the entering temperature, velocity and direction of the air, and the location and type of the grilles through which the air is admitted.

Plans for the work have been partially completed and a co-operative program has been arranged to be carried out at Marquette University in Milwaukee in cooperation with the Research Laboratory. Equipment is being installed whereby conditioned air can be supplied to a room. The air conditioning and control equipment will include water cooled surfaces supplied with water from a large tank and Baudelot coil, and refrigeration for cooling the water, supplied by a 3-ton ammonia compressor. Additional control and measuring equipment is being installed in order to give complete operating control of test conditions.

16. MINIMUM TEMPERATURE AND METHOD OF INTRODUCTION OF COOLING AIR IN CLASSROOMS

Perry West, *Chairman*

J. D. Cassell — A. J. Nesbitt
S. R. Lewis — G. E. Otis
J. R. McColl — C.-E. A. Winslow

This study aims to establish the relation of the temperature and other characteristics of the air discharge into a room by a unit ventilator to the prevalence of drafts. During a large part of the time, even during the heating season, proper school ventilation is a cooling rather than a heating problem. It has been well demonstrated that body heat given off by the children is sufficient to maintain proper room temperature with some minimum outside temperature which may range as low as 40 to 50 F, with no sunshine. For rooms on the sunny side of the building the combined heat source from children and sunshine is sufficient to maintain the desired temperature indoors with considerably lower outside temperature.

When cooling is required, it may be had with a unit ventilator either by bringing in the proper volume of outside air at the prevailing outside temperature, a larger volume of air with the addition of some heat in order to give a desired temperature to the air blown into the room, or by the proper volume of outside air at the prevailing temperature mixed with sufficient re-circulated air, in order to give a desired temperature to the air blown into the room. These possibilities make desirable a study to determine the minimum satisfactory temperature at which air can be so admitted into a classroom without giving the effect of cold drafts on the children in some portions of the room, and also the quantity of outside air in cfm per pupil that must be brought in under each of the three above mentioned conditions for various outside air and weather conditions and various classroom exposures.

It is admitted that a wide variation of low temperatures of air admission may theoretically be possible with an air jet into the room having proper velocity, location and direction for any particular room in question. However, it is obvious that with units designed and built in a factory for installation in any classroom under a wide variety of conditions there must be some minimum temperature of air admittance below which freedom of cold drafts can be insured under all practical conditions of installation, operation and room design. It is this minimum which it is proposed to have established by the investigation.

PRESIDENT'S MESSAGE TO MEMBERS

RESEARCH

When research displaces guesswork facts are disclosed that make real progress possible. The AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS has attained its leadership among engineering societies very largely because of its sponsorship of research to learn the fundamental facts in its field.

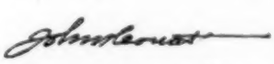
The established policy of the Society has been to confine its efforts to research in its TRUEST sense. As a consequence of this policy, noteworthy results have been achieved in accumulating data and establishing the fundamental principles underlying the physiological response to air conditions, in determining the heat transmission through various types of building materials and constructions, in obtaining data on heat losses resulting from air infiltration, in studying the effect of the sun on the cooling load under summer conditions, and in studies in other fields too numerous to mention in a letter.

Much has been accomplished in the accumulation of laboratory data on the component parts of general problems. Satisfactory solutions of these problems could be assured if the assumptions required in the practical application of the data could be made to conform with all of the conditions under which the laboratory results were obtained. In many cases, however, the factors governing the practical application of the data are not controllable, and the integrated effect of these factors is such that the composite result may deviate widely from the result obtained by separating the problem into a number of component parts and combining the solutions for these various parts. This is particularly true in the case of heat losses from buildings. In response to this need for data obtained under practical operating conditions, the research organization has undertaken a comprehensive study of the heat losses from actual buildings. This study will be a broad one and will require considerable time for completion, but the results will justify the expense and efforts devoted to it.

The need is great for further studies on the physiological response to air conditions, particularly under summer conditions, and on the effect of air environment on general health. A study of the former is being started by the A.S.H.V.E. Research Laboratory, and on the latter through the establishment of a Fellowship at the Mayo Clinic in Rochester, Minn. These studies involve a long time program, and the results will be invaluable, both from the immediate practical standpoint and from the standpoint of the future health of the users of air conditioning equipment.

In addition to the function of collecting data, the A.S.H.V.E. Research Laboratory has a very important function in the dissemination of the information thus obtained, and in the correlation of information available from work of others in these related fields. It is not as generally well known as it should be that the Research Laboratory maintains a complete index of all publications in the field of thermal research, and is ready at all times to give information covering a survey of the literature available and the work being done by others in heating, ventilation and air conditioning. This service is available for all members of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS, and it is hoped that more general use will be made of it in the future than has been in the past. If you need such information write to the Director of our Research Laboratory for it.

March 1, 1935



President,
AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.

Proceedings of the 41st Annual Meeting

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS

Buffalo, N. Y.—January 28-30, 1935

THE 41st Annual Meeting of the A. S. H. V. E. was attended by 350 members and guests during January 28-30, at the Hotel Statler, Buffalo, N. Y. The technical sessions, at which committee reports and 12 technical papers were presented, were noteworthy for their interested and continued attendance. An enjoyable entertainment program had been arranged by the Committee on Arrangements of Western New York Chapter and the efficiency and enthusiasm of the local members in the performance of their duties was apparent.

A meeting of the Council took place on January 27 and registration began at 8:30 a. m. on January 28.

FIRST SESSION—
Monday, January 28, 1935, 10:00 A. M.

Pres. C. V. Haynes, Philadelphia, Pa., opened the 1935 Annual Meeting of the Society in the Terrace Room of the Hotel Statler and introduced L. A. Harding, Buffalo, N. Y., chairman of the Reception Committee. Mr. Harding extended greetings on behalf of the Western New York Chapter and a hearty and cordial welcome, to which President Haynes responded briefly.

The first technical paper on the program, entitled Some Recent Studies on the Ashes in Coal by Prof. T. G. Estep, Pittsburgh, Pa., was read by Mr. Harding in the absence of the author because of illness. (Complete paper published in December 1934 Journal Section, *Heating, Piping and Air Conditioning.*)

The Report of the Council was read by the Secretary.

Report of the Council

Since the last Annual Meeting the Council has had four meetings, February 8, June 19, October 22 and January 27, and it has carried on the business affairs of the Society as required by the Constitution and By-Laws. At the organization meeting of the Council, Pres. C. V. Haynes announced the personnel of Council Committees and Special Committees and Technical Committees were selected.

The Secretary, A. V. Hutchinson, was reappointed and the Budget prepared by the Finance Committee was adopted. This Budget providing for an income of $49,277.00 exclusive of Research and an expense of $49,100.00 has been closely adhered to on the expense side and the income has been materially increased because of improved dues collections and the extremely favorable showing of THE GUIDE as given in detail by the Reports of the Finance and Guide Publication Committees.

Because meetings of the Council have been less frequent during the past two years, much of the business was again handled by correspondence. This volume of correspondence was augmented by activity on the Engineers Code directed by Mr. John G. Eadie, the Society's representative. The Council approved recommendations for publication of THE GUIDE 1935, and established a budget for printing 8,500 copies.

Depositories for Society funds were selected. Various invitations inviting the Society to hold future meetings in many parts of the country were received and discussed.

The invitation of the Illinois Chapter to have the 42nd Annual Meeting, January, 1936, in Chicago was accepted and arrangements have been made to hold the Heating and Ventilating Exposition in International Amphitheatre, Union Stock Yards.

As required by the By-Laws, the Council nominated five members to serve on the Committee on Research for a term of three years and appointed Prof. F. E. Giesecke as the Society's representative on the National Research Council.

At the Council's October meeting in Buffalo, approval was given to the Annual Meeting program and the dues rate for 1935 was announced. The request of the Illinois Chapter to establish a limited chapter membership was granted and approval of the new Constitution and By-Laws for the Massachusetts Chapter was given.

In accordance with the provisions of Article B-II, Section 1 of the By-Laws, resignations of members were accepted and the cancellation of membership as required by Article B-II, Section 2, totaled 377 and elections of 293—net loss of only 84 this year. Every possible means was used to collect outstanding dues in arrears and a special effort was made throughout the year to have as many members as possible retain their affiliation but it was necessary to cancel many memberships on December 31st.

The Council is glad to report to the membership that the Society's financial affairs are in good condition and that there is an indication of growing interest in the Society's activities and a definite trend toward a larger membership for 1935.

Respectfully submitted.

THE COUNCIL.

On motion of J. D. Cassell, Philadelphia, Pa., which was seconded and carried, the Report of the Council was received and filed.

The Report of the Secretary was then introduced and President Haynes announced that the reading would be dispensed with, since the report would appear in the Proceedings.

Report of the Secretary

This brief review of the work done by the headquarters office staff during the past 12 months will serve to indicate the many activities involved in conducting the Society's business. The year 1934 started with a smaller personnel than had been employed since 1920. To carry on the Society's work effectively necessitated a rearrangement of assignments in order to divide that work which could not be curtailed. As events transpired, however, the volume of business showed a substantial increase and routine duties were very heavy because of better dues payments, an increased demand for copies of THE GUIDE 1934, and an increase in GUIDE advertising of almost 40 per cent over the previous year.

Each month material was obtained and prepared for publication in the JOURNAL and after the papers were reviewed and approved by the Publication Committee, styling, editing and proof reading were handled by the office staff in addition to the

preparation of news notes and the chapter reports furnished by the local secretaries. About 300 pages of JOURNAL material were presented in the columns of *Heating, Piping and Air Conditioning.*

Due to the increased size of THE GUIDE 1935, which will come to members about February 25th, the work of styling, proof reading, making-up and checking this volume of over 1,000 pages, presented a difficult problem so that additional temporary help had to be obtained during the last few months of the year. To give some conception of just one portion of THE GUIDE work, that of proof reading, it might be visualized by comparing it with reading 20 full sized novels and then remembering that all of this must be done within a period of a little over two weeks.

At the same time that the text was being prepared, another phase of THE GUIDE work was actually under way, namely that of securing contracts from manufacturers for catalog data space. Only limited personal contact was feasible, so that a great portion of the sales promotional effort had to be made by mail campaigns. This program was energetically carried on from September to January and a total of 15,000 letters were sent out.

Earlier in the year, from February to September, an active mail campaign was carried on to sell copies of THE 1934 GUIDE and by October 15 none of this edition of over 8,000 copies could be supplied. The sales exceeded the budget estimate by about $3,000. In this campaign, over 30,000 mailing pieces were sent out.

In addition to handling all of these individual orders, preparing labels for shipment and then billing and collecting several thousand accounts demands much time.

During the year 325 applications for membership were received and these were prepared for the Committee on Admission and Advancement. When an application comes in the minimum number of letters required before a candidate can be notified of his election is 8 provided it is not required to write for dues check, follow-up proposers and seconders or write the candidate for supplementary information.

An important function of the office is the matter of keeping mailing addresses up-to-date. On every dues bill sent to members there is a place provided for giving address changes and members are urged to cooperate in notifying the Secretary's office of any change in their business or location. Frequently this is neglected and mail is delayed in delivery or returned.

In the case of a copy of THE GUIDE or TRANSACTIONS this is very expensive and adds to the postage expense. A typical example would be shipment of THE GUIDE to Chicago, costing 24c. If it is returned because of non-delivery the expense is another 24c and when we find out his new location and again make shipment at some later date there is another charge.

Because of the shifting activities of members during the past few years, changes on the mailing list have been exceedingly heavy and costly. To illustrate the condition existing, in 1934 the records show nearly 800 changes of addresses in addition to 293 newly elected members and the revisions required by the loss of members. It should be remembered that these changes must be recorded on four separate files and in the case of members affiliated with chapters, the local secretaries must be notified.

During the year, Annual and Semi-Annual Meetings have been organized and the headquarters office in cooperation with the Meetings Committee is responsible for the details of the technical programs. This involves securing committee reports, technical papers and speakers, cooperating with the local chapter officers and committees which handle the entertainment functions and local arrangements in the meeting city.

In 1934 the Society headquarters again functioned as a clearing house for engineers engaged in heating, ventilating and air conditioning work and kept them informed of developments on the Engineers' Code for the Construction Industry. John G. Eadie, consulting engineer of New York, acted as the Society's representative and served as a member of the Code group which submitted the revised Code for approval. Because of changes made by NRA divisions in the draft approved by the engineering group, the Code has remained dormant.

The effort of the Society to obtain employment for members has been continued actively during the year and many leads have been furnished and a considerable number of placements have been recorded with mutual benefit to employers and those who have been looking for employment. This work entailed heavy correspondence during every month of the year.

Three new Codes were added to the list of A. S. H. V. E. Standards in 1934, as a result of a letter ballot vote by Society members. These Codes cover the subjects of Testing and Rating of Return Line Low Vacuum Heating Pumps, Testing and Rating Air Cleaning Devices used in General Ventilation work and Testing and Rating Concealed Gravity Type Radiation (Hot Water).

Several proposed changes in the Society's Constitution and By-Laws were voted on by members of the Society during the year and these related to the extension of time during which the Council is authorized to set the annual rate of dues and initiation fees, also the qualifications for student membership. The required notices and letter ballots were sent to members eligible to vote.

Both directly and through specially appointed members, there has been active cooperation with the local chapters and from time to time announcements and notices, list of subjects for discussion and available speakers have been furnished to local chapter officers.

In addition, there are numerous routine matters and correspondence to be handled, hundreds of inquiries from non-members requesting sources of information, reprints and codes, so that the headquarters office staff has a variety of duties to perform to carry on the work of the Society.

It is a pleasure to acknowledge the cooperation given to the Secretary by the Officers and Council Members, the Chapter Officers and Committees as well as the Research Laboratory, which assisted in handling some of the technical correspondence.

The members I feel sure will join the staff in congratulating one of its members, Miss Pauline Kurland, for her good fortune in surviving the Morro Castle disaster.

This report would not be complete without expressing appreciation to the regular members of the staff, the Misses Babcock, Converse, Kurland and Mildner, for not only the faithful performance of their regular duties but for their willingness to give extra time to the extent of more than 1,000 extra hours during the year because of their interest and loyalty to the Society, without thought of additional compensation.

It is significant that when the cost of administration of Society activities is carefully analyzed and checked with the reports of comparable organizations, it is found to be exceedingly low.

Respectfully submitted,
A. V. Hutchinson, Secretary.

The Report of the Committee on Admission and Advancement was read by R. H. Carpenter, New York, N. Y., at the request of A. J. Offner, chairman of the Committee, who could not attend because of a broken leg.

Report of Committee on Admission and Advancement

During the calendar year 1934, the Committee on Admission and Advancement received and reviewed 231 applications for membership, which resulted in the election of 84 Members, 66 Associates, 33 Juniors, and 48 Student Members, or a total of 231 new members for the Society.

Your Committee wishes to impress upon members who act as proposers and seconders of candidates for membership the importance of familiarizing themselves with and explaining to the applicant the Constitutional requirements for the different grades

of membership, and also to point out to them the necessity of giving fully detailed information as to their training and experience. Furthermore, the sponsors must give such confidential information necessary for the guidance of the Committee in determining the grade of membership to which the applicant is entitled. The lack of such full information and cooperation was evident in many applications, and resulted in a few cases in great disappointment to the applicant in the grade of membership voted him. While the Committee in no case has tried to keep an applicant from the grade of membership he is entitled to, it could not and would not vote a higher grade than the Constitution and By-Laws permitted and the submitted information seemed to indicate. Membership in the AMERICAN SOCIETY of HEATING AND VENTILATING ENGINEERS must not be too easily acquired, nor be based on insufficient experience or training. Membership must be of such high standing as to be of pride to the member and of respect to non-members.

Your Committee wishes to call attention to the great increase in the number of student members admitted during the past year, especially as this grade of membership is carried at a financial loss to the Society. The number of student members increased during the year from 125 to 173 members. If this rate of increase is maintained, the strain on the treasury may become of grave concern. Either the number of publications these members receive should be reduced, or the annual fee increased to cover at least the actual cost. Furthermore, both the applicant's age and number of years this grade of membership may be held should be strictly limited. We of the Committee do not think the proposed constitutional amendment will fully accomplish the desired results.

In conclusion, the members of the Committee wish to express their sincerest thanks and appreciation for the constructive help given them by proposers and seconders, Council Members, the National Secretary, and the office staff at Society's headquarters.

Respectfully submitted,
John G. Eadie,
E. Nute Sanbern,
Alfred J. Offner, *Chairman*,
COMMITTEE ON ADMISSION AND ADVANCEMENT.

It was voted upon motion, duly seconded, that the report be accepted as read.

Mr. Carpenter gave the Report of the Finance Committee, of which he was chairman.

Report of Finance Committee

The presentation of the Finance Committee's Report is a much pleasanter task than it was a year ago. At that time a deficit was in sight—a deficit which was held at a low figure only because, in the middle of the year, the budget had been revised and some drastic reductions made. Mr. Howatt very wisely bore this situation in mind in preparing the budget for 1934 and, as a result, income was estimated as pessimistically as possible and expenses held to a figure that provided for the bare existence of the Society but little else. The extent to which this kind of planning was justified is best summarized by the simple statement that the 1933 deficit of $736.00 has been followed by a 1934 surplus of $8,191.00—a fact that is a source of much gratification to the members of the Finance Committee. The results accomplished are, in a large measure, due to the hard work and cooperation of Secretary Hutchinson and his staff in the collection of dues and the careful watching of office expenses.

The income of the Society comes from three principal sources—Dues from Members, Editorial Contract and Guide Advertising and Sales. Dues collection from members for the calendar year 1934 have been $2,778.00 in excess of the budget estimate. Guide advertising has been $5,522 in excess and Guide sales $2,849 in excess of budget expectations. The total gross revenue in excess of the budget estimate is $13,065.97, reduced to a net surplus of $8,191.34 by the excess cost of the Guide over that anticipated due to the increased number of copies printed, fixed charges which were unbudgeted, accounts receivable, depreciation, etc. The accounts receivable from members in arrears of dues amounts to $9,723.00 for the year 1934, with an additional $16,695.00 due for 1933 and prior years. Approximately $6,000.00 of these sums are in the form of notes. In preparing the 1935 Budget, all unpaid dues for years prior to 1934 have been considered as valueless; for which reason only last year's arrears have been taken into consideration for budget purposes. Even this figure has been written down 75 per cent, with the result that the anticipated revenue from all unpaid dues is set at $2,430.74.

During the year the Council, upon the recommendation of your Finance Committee, sold $5,000 par-value bonds of the Metropolitan-Edison Co. Although these bonds had been listed at far below par, their market value, at the time of sale, was much more favorable, and the bonds were sold for $4,731.65. This money is now on deposit awaiting investment in United States Government securities, as required by the By-Laws. Securities owned by the Society, exclusive of Research Funds, as of Dec. 31, 1934, cost $26,722.71, with a market value substantially higher than was the case a year ago.

The Society's capital account, of net worth, on Jan. 1, 1934, was $32,458.10. The corresponding figure as of Jan. 1, 1935, is $41,393.53, an increase of $8,935.45. This increase is due to the operating profit as outlined previously, supplemented by inventory items and modified by the loss on the sale of the Metropolitan-Edison bonds.

The balance sheet, as of Jan. 1st of this year, shows the following figures. For purposes of comparison, the corresponding figures of a year ago are given also:

	1934	1933
Cash on hand	$26,074.96	$11,939.99
Collectable accounts	23,197.30	21,776.90
Total invested assets, at cost	28,740.60	30,721.38
Other assets and inventories	5,222.46	4,866.79
Notes receivable	653.50	455.36
Total current assets	53,412.21	36,781.48
Total assets	84,498.13	69,760.42
Current liabilities	17,965.12	15,372.77

From the above it will be seen that the current assets are 2.97 times the current liabilities, from which we may conclude that the Society is in a sound financial condition.

Respectfully submitted,
F. C. McIntosh,
J. F. McIntire,
R. H. Carpenter, *Chairman*,
FINANCE COMMITTEE.

January 27, 1935.

Mr. Cassell moved that the report be accepted and filed and this was properly seconded and carried.

President Haynes introduced J. S. Snyder, Buffalo, N. Y., who reported for the tellers who recorded the vote on the amendment to the Constitution.

Report of Tellers

The votes cast for Amendments to the Constitution have been tabulated by the Board of Tellers and the following results are reported:

Art. C-II Sec. 7	yes 388; no 9
Art. C-III Sec. 4	yes 390; no 7
Total number of votes cast	447
Total legal votes	397

Respectfully submitted,
H. A. Hexamer, *Chairman*,
Wm. Roebuck, Jr.,
C. H. Love.

January 26, 1935.

J. J. Landers, Buffalo, N. Y., gave the Report of the Tellers for Election of Officers as follows:

Report of Board of Tellers

The votes cast for Officers have been tabulated by your Board of Tellers with the following results:

President—John Howatt..... 416
1st Vice-Pres.—G. L. Larson... 415
2nd Vice-Pres.—D. S. Boyden.. 416
Treasurer—A. J. Offner..... 416

Members of the Council—3-year term:
J. F. McIntire..... 414
Albert Buenger 416
F. E. Giesecke..... 416
W. E. Stark..... 416

The votes cast for Members of the Committee on Research have been tabulated by the Board of Tellers with following results:

Three year term:
C. A. Dunham..... 415
W. L. Fleisher..... 416
Elliott Harrington 416
A. P. Kratz..... 416
H. C. Murphy..... 416

Total number of votes cast..... 475
Total legal votes..... 416

Respectfully submitted,
L. A. Cherry, *Chairman.*
R. T. Thornton,
J. J. Landers.

January 26, 1935.

Announcements concerning program and entertainment features were made by M. C. Beman, Buffalo, N. Y., General Chairman of the Committee on Arrangements.

The Report of the Membership Committee was read by F. C. McIntosh, Pittsburgh, Pa., chairman of the Committee.

Report of the Membership Committee

Since the last annual meeting, 293 members have been elected to the various grades of Membership, as follows:

Members	99
Associates	73
Juniors	37
Students	84
	293

There are about 55 applications under consideration.

Although no drive was undertaken, an attempt was made to present the advantages of membership to those who might be eligible.

The unusual feature this year has been the high percentage of students. The new sources of such members are:

Case School of Applied Science, Cleveland, O.
University of Oklahoma, Norman, Okla.
University of Minnesota, Minneapolis, Minn.

It is hoped that expansion in this direction will be of distinct benefit to the younger men about to enter our field, and also to our society, in that these men are likely to carry their affiliation beyond the student grade.

Progress has been made toward the establishment of chapters in the following cities:

Baltimore	Oklahoma City
Dallas	Omaha
Denver	San Francisco

Some or all of these groups, but particularly Baltimore, Denver and Oklahoma City, with help from us, can be in position to apply for charters within the coming year.

Present membership or geographical location suggests the formation of chapters in the following other cities:

Atlanta	New Orleans
Indianapolis	Vancouver
Montreal	Washington
	Winnipeg

And there are still other cities or districts with probably enough good men to make up an active chapter group. The Albany-Schenectady-Troy district is mentioned as an example.

As the trend of Society thought indicates an increasing interest in chapter activities on the part of the national organization, there is, or should be, a greater incentive for the establishment of additional chapters.

It is the recommendation of this committee that all of us attend and extend the activities of our local chapters where they exist, and where they do not, that we develop informal groups, if possible, to take their place until they can be formed.

We acknowledge with thanks the great assistance we have received from so many of our members that we are unable to name them here.

Albert Buenger,
W. A. Russell,
F. C. McIntosh, *Chairman,*
Membership Committee.

On motion of Mr. Cassell, seconded and carried, the report was accepted and filed.

The first session then adjourned.

SECOND SESSION—

Monday, January 28, 1935, 2:30 P. M.

President Haynes presided at the Second Session and introduced John Howatt, Chicago, Ill., chairman of the Committee on Research, who gave the report which appears on page 152 of this issue of the Journal.

Prof. G. L. Larson, Madison, Wis., moved that the report be filed and that Mr. Howatt be given a vote of thanks for the fine work he had done as chairman of the Committee on Research. The motion was seconded and carried.

President Haynes announced that the paper, Cooling Requirements of Rooms in an Unconditioned Office Building by F. C. Houghten, and Carl Gutberlet, would be given by the senior author. He then turned over the gavel to Mr. Howatt. (Complete paper to be published in the Journal Section, *Heating, Piping and Air Conditioning*).

Mr. Houghten, director of the Society's Research Laboratory at the U. S. Bureau of Mines, Pittsburgh, Pa., gave a resumé of the studies reporting work carried on under the Technical Advisory Committee on Heat Requirements of Buildings. Questions were asked by E. K. Campbell, Kansas City, Mo., Prof. G. L. Tuve, Cleveland, Ohio, and Mr. Howatt, to which the author replied. Subsequent discussion was given by L. A. Harding, Buffalo, and J. H. Van Alsburg, Holland, Mich.

Chairman Howatt introduced Prof. M. K. Fahnestock, Urbana, Ill., who presented the paper, Study of Unit Room Coolers in the Research Residence by A. P. Kratz, M. K. Fahnestock, and S. Konzo. (Complete paper published in November 1934 Journal Section, *Heating, Piping and Air Conditioning*). The work reported was done under a cooperative research agreement at the University of Illinois.

The lengthy and spirited discussion, which followed, attested to the timely interest of the paper and was opened by Prof. W. M. Sawdon, Ithaca, L. A. Harding, Buffalo, and W. L. Fleisher, New York, to whom Pro-

fessor Fahnestock replied. Additional suggestions and comments were made by Mr. Fleisher, Professor Kratz, W. D. Jordan, New York, Mr. Harding, C. L. Toonder, Detroit, Mich., G. B. Helmrich, Detroit, Mich., and John Everetts, Jr., New York.

Chairman Howatt thanked the authors for the paper and its presentation and the session adjourned at 4:45 p. m.

THIRD SESSION—

Tuesday, January 29, 1935, 10:00 A. M.

On Tuesday morning President Haynes called the meeting to order and introduced F. C. Houghten, Director of the Society's Research Laboratory who presented his paper, A Carbon Monoxide Alarm and Ventilation Control. (Complete paper published in March 1934 Journal Section, *Heating, Piping and Air Conditioning*).

Mr. Houghten pointed out that the Laboratory had assisted the Garage Ventilation Code Committee on several occasions and the current paper described a control instrument which would indicate hazardous concentrations of carbon monoxide. Mr. Houghten's presentation was accompanied by numerous slides by means of which he described the various Laboratory methods of determining carbon monoxide and the use of a known principle in the new recorder which measures the quantity of carbon monoxide present, by means of temperature rise when the carbon monoxide is oxidized to carbon dioxide. Dr. E. Vernon Hill inquired about the closeness of the control and J. H. Walker asked whether the instruments could be purchased. Mr. Houghten stated that the instrument will operate at 2 parts in 10,000 and will turn the fan on and off within the limits of about one-half of a part in 10,000. He also stated that the instrument was now being made for sale by a Pittsburgh manufacturer.

Garage Ventilation Code

A report of the Committee on Garage Ventilation was presented by E. K. Campbell, Chairman. He gave a brief review of the work that had been done by the Society since 1925 and of the cooperative efforts undertaken with the *National Fire Protection Association* which resulted in the development and adoption of a Code issued by the National Board of Fire Underwriters, that is now used by insurance companies.

A series of investigations was attempted by the Society in St. Louis, Boston and Pittsburgh in several commercial garages and work was carried on at the University of Kansas in Lawrence and also in Kansas City. As a result the Committee has prepared a Code for submission to the Society and these sections which relate to fire protection conform very closely to the text of the Fire Underwriter's Code. The highlight of the Code however, is the carbon monoxide section where a standard of not more than one part in 10,000 parts of air where men are working 4 or more hours per day has been established. The Committee has given standards for installation, has recommended instruments for detection of carbon monoxide and has suggested a method of introducing air based on the series of tests that have been conducted.

Discussion of the Code was contributed by Messrs. Thompson, Philadelphia, Alt, New York, Fleisher, New York and Mr. Campbell answered the various questions which had been asked.

The complete text of the Committee's report is to be furnished to all members for discussion.

W. L. Fleisher, New York, presented the report of the Guide Publication Committee.

Report of Guide Publication Committee

The Guide Publication Committee, through its Chairman, brings a report covering the activities of the past year, that is full of optimism, justified we believe because of the future outlook and the progress made through the enormous amount of work that the Committee has had to devote to THE GUIDE during this period.

Before going into details, just for a moment please recall that due to the great financial embarrassment, not only of the Society but the country at large, that the 1934 Guide Publication Committee was handicapped by the absence of a technical secretary. When, in June of 1933, a technical secretary was dispensed with, the Guide Publication Committee, under my chairmanship, found itself with practically the whole Guide in front of it and nothing in shape for publication and no coordination of material. It was essential, therefore, for your Chairman to drop practically all his other activities and to devote most of his time from June, 1933, until the publication date of THE GUIDE 1934. The Guide Publication Committee of that year, and I think the Society, felt that these efforts were justified in that THE GUIDE 1934 was eminently successful not only from the standpoint of its technical data, but also from its general sales, the issue having been sold out in the early part of the fall of 1934. The commendations that resulted from this issue were generally favorable.

Your Chairman, however, during this period learned a great deal more about THE GUIDE and its possibilities than he had known before, although he had served as a member of the Guide Publication Committee for several years before that. When he was approached to assume the responsibility for THE GUIDE 1935, he felt that although for business reasons he should not assume this responsibility, nevertheless, he felt that THE GUIDE had such possibilities of service to the industry and such possibilities of adding materially to the support of the Society, that he reluctantly accepted the chairmanship for another year on the condition that the Committee work should be divided among people absolutely competent to assume the responsibilities of the work assigned to them without very much assistance from the Chairman, who would outline and assign the work, but who was not supposed to do as much of the actual work as he had done for THE GUIDE 1934. Your Chairman also imposed a condition on his assumption of the chairmanship, which was that THE GUIDE should be designed and revised in such a way that no future chairman or no future committee, unassisted by paid technical assistance, should have the major duties which for the last two years, due to the financial condition of the Society, have been imposed on the Chairman, and that THE GUIDE should be put in a position to have an earning capacity that its set-up and its general trend had not presented before. In other words, the Chairman of your Committee felt that if THE GUIDE could, without in any way destroying its impartial attitude, make a greater appeal to the manufacturers, either through its circulation or because of the interest that could be generated in the younger generations, who would be future buyers, or by presenting something to the manufacturer that he could further broadcast, that THE GUIDE could be made into a publication which would not only support itself, but which would practically support the Research Laboratory of the Society.

In revising the chapters which applied to manufactured articles the Committee obtained the cooperation of engineers from the organized groups of manufacturers so that the text matter of THE GUIDE would represent the latest practice and developments.

The thing of major importance that your Chairman was interested in was developing through capable assistants, unpaid it is true, but interested in the Society, problems in practice referring to the text of the chapter which would make an appeal to the schools and colleges and industrial concerns selling apparatus, so that the text embodied in THE GUIDE would have a new interpretation and would create comment and criticism which would lead to the normal and logical development of the text in future issues, based on the problems in practice which were presented to the Guide Publication Committee by outside sources. Your Chairman felt that these problems in practice, which are the major change in THE GUIDE 1935, could readily be changed from year to year, adding new problems, and adding new answers, so that without changing the fundamental text matter, which he was particularly anxious should remain undisturbed for a number of years until the various readers of THE GUIDE and those referring to it became accustomed to it, THE GUIDE, itself, would still be a new book each year simply by bringing the general data up to date and changing the problems and the answers.

When sufficient comment and criticism had been offered, or when sufficient time had elapsed for the interpretation of the chapter to have been thoroughly understood through the problems that were presented, then the text of the chapters, themselves, could be changed without the necessity of calling in outside parties to re-write them.

With all of these major problems in mind, your Chairman accepted his job and called a meeting of the Guide Publication Committee in Chicago in April, which meeting every member of the Committee, without expense to the Society, attended. Besides the actual Committee, your Secretary, who has been absolutely invaluable in this entire work, and your President also attended this meeting. After a full day's meeting, the plans that had been formulated were accepted and starting as early as April, it was assumed that the work of getting out the new GUIDE would progress very rapidly and be in good shape for early publication. However, due to the very major changes that this whole idea involved, and the fact that the aspects of THE GUIDE had to be so carefully considered, and that all of the Committee men were very busy men (outside of THE GUIDE work that they had so very generously assumed), by the end of June, when another meeting was held at Buck Hill Falls, work had not progressed nearly as rapidly as your Chairman and the balance of the Committee had hoped. It was essential, in order to accomplish the major changes that had been determined by us, to have the services of J. L. Blackshaw, who had been assisting Director Houghten in the Research Laboratory. Your Committee, working with Mr. Blackshaw, was able to get sufficient assistance so that at this meeting we can announce that THE GUIDE in its new form, with about 150 additional pages, is nearly ready for distribution and that in the mind of your Chairman, the "Problems in Practice" which are appended to every chapter so greatly broaden the information and scope of THE GUIDE, that all members of the Society will be able to look upon it with great pride, and use it with great value.

The enthusiasm of the Committee and the work of Mr. McDonnell and of your Secretary, Mr. Hutchinson, spread also to the advertisers and nearly 40 per cent increase in advertising is embodied in THE GUIDE 1935. We all feel that when this Guide, with its new set-up and increased advertising, is in the hands of the public and in the hands of the colleges and schools, that the following issues will not only be of greater service, but that the advertising will double or triple in the near future.

I give herewith a tentative estimate of receipts and expenditures of THE GUIDE 1935:

Income

Guide advertising (1935)	$21,022.00	
Guide copy sales (1934)	11,349.09	
		$32,371.09

Expense

Printing and Binding	$11,600.75	
Mailing	2,000.00	
Paper	2,447.52	
Engraving and Art Work	342.01	
Advertising Sales Promotion (1935)	1,651.73	
Copy Sales Promotion (1934)	2,480.69	
Editorial and Clerical	1,208.08	
		$21,730.78

Of course, all these things have been helped by the increase in the interest in air conditioning and although the chapters on air conditioning have not been too greatly changed except in the complete re-writing of such chapters as Unit Air Conditioners, nevertheless, the questions and answers appended to the chapters on air conditioning so broaden the scope of those chapters, that no one interested in air conditioning can afford to be without a copy of THE GUIDE.

Your Guide Committee will accept criticism or comment on all "Problems in Practice." In that way we hope to improve and perpetuate THE GUIDE for a much larger and more beneficial use.

In order to further the general interest in THE GUIDE and in the Society and to increase the revenues of the Society, your Chairman has proposed to the Council that some award be created for students in the schools and colleges to submit new "Problems in Practice," based entirely on the interpretation by an individual of the text of the chapter. The best questions and answers or the best group of questions and answers would then be published in the following issue of THE GUIDE and the person submitting the best set should be given as an award a fully paid trip to the summer meeting of the Society. Further, your Chairman has suggested that minor awards be made for other sets of questions and answers submitted.

A good many years ago, when your Chairman was doing certain work for Smith Brothers, the advertising agent of that company informed him that they distributed thirty million blotters a year to the school children of the country so that when the children grew up, cough drops and Smith Brothers were synonymous in their minds.

Your Chairman feels that the making of such awards as have been outlined for the best questions and answers submitted, based on the text in THE GUIDE, will have a similar effect on the minds of the students in the schools and colleges of the country and that what they see or read in THE GUIDE during this formative period will make such an impression, that when they are full-fledged engineers or connected with companies purchasing any material advertised in THE GUIDE, that they will think of those names and those things which have been impressed upon them during their formative period. In this way THE GUIDE becomes of greater importance to the advertiser and should increase the potential possibilities of THE GUIDE as an advertising medium enormously.

During the past year 8,000 copies of THE GUIDE 1934, were distributed and sold. Feeling that THE GUIDE 1935, will be of much greater importance, we have authorized the printing of 10,000 copies for this year and think that there should be no difficulty in disposing of them. If we do, THE GUIDE will be a really very successful financial proposition and will have justified all of the enthusiasm and all of the optimism which your Chairman and the Guide Publication Committee have felt.

There is only one other thing which has been advocated or developed by your Committee, which is the possibility of distribution of separate chapters by manufacturers, the manufacturer adding to the reprint of the chapter that advertising which he has published in THE GUIDE, itself. For instance, some of the unit air conditioning people having 1,800 agencies and probably five times that amount of distribution, having prospective customers amounting to, maybe, a million, might, with profit, purchase from the Society large quantities of reprint chapters with

problems and answers and their advertising attached thereto for free distribution to their prospective customers.

In this way we can increase the general use of THE GUIDE and the revenues of the Society. With all of these advanced ideas and possibilities of circulation and sale, there may be a question as to the reason for our not having printed more than 10,000 copies. The answer is that if more than 10,000 copies can be properly distributed, the advertising rates under which we are now operating are too low. If it seems possible from the acceptance of THE GUIDE 1935, that twelve or fifteen thousand copies of THE GUIDE 1936 can be distributed, then the Society must raise the rates for its advertising to substantially increase the income of the Society.

Your Chairman is anxious to bring up the point that he discussed with the Council last year, and that is the question of closer cooperation and a closer connection between THE GUIDE and the Research Laboratory. The Guide Publication Committee has used advantageously the research part of the Research Laboratory and in its chapters, THE GUIDE has incorporated those findings of the various research departments of the Society—that means the Pittsburgh work and all of the university findings that the Committee felt were well enough established to be incorporated in THE GUIDE. Of course, it must be understood that the Research Laboratory, being so badly handicapped for funds, has been unable to undertake quite a few of the important problems that have arisen during the last few years. This year your Chairman served also on one of the special technical committees, the one on Air Conditioning in Relation to Comfort and Health, and from this association was able to gather enough information to change and correct some of the text matter of THE GUIDE. It is for this reason that he feels that the Guide Publication Committee should be very closely allied to and associated with the technical advisory bodies of the Society, so that the findings of these various bodies and the Research Council should find expression in THE GUIDE text or that THE GUIDE text should be edited to exclude those things that these various bodies find are not definitely enough established to warrant publication.

The Chairman wishes to bring out the fact that in the chapter on Coefficients of Transmission the cuts which have not been printed since THE GUIDE 1932 have been improved and altered and re-introduced into THE GUIDE 1935, and that the psychrometric chart has been re-drawn and republished as a separate sheet. As everybody working on heating and air conditioning, in which the total heat of the air is used as a function of design, has had so much occasion to use this chart, the Committee felt that even though it added to the expense of publication, that it should be republished and revised in easily usable form. Many additional copies of this chart have been printed, and it is the feeling of the Committee and of your Secretary that to obviate the necessity of removing this chart from THE GUIDE, itself, that all the purchasers of THE GUIDE, or all those receiving THE GUIDE as part of their dues, should be given the privilege of buying detached copies at twenty-five cents as against the regular price of fifty cents which would be charged to the general public.

It is the Committee's opinion, and it is made as a suggestion, that the Society, through selected committees, should approach the various organized manufacturing groups with the idea of having them select and pay for someone who is sufficiently competent and skilled to write a new chapter covering the technical and practical side of the apparatus or material that they sell, and that such chapters, after being written by designated authors, should, of course, be reviewed by the Guide Publication Committee. As the manufactured articles employed in heating, ventilating and air conditioning are changing rather rapidly today, it is the feeling of the Guide Publication Committee that a more up to date, practical and complete chapter could be written by such a man, acting under the direction of the group, than it could be by an individual selected by the Committee.

Although at this particular time it is early to be too elated about the success of the efforts of the Guide Publication Committee, nevertheless, it is with a great feeling of satisfaction and pleasure, and with thanks to the Sub-Chairmen of the Committee, to your Secretary, Mr. Hutchinson, to the Chairman's Assistant, Mr. Blackshaw, and to the approximately two hundred people who have assisted him with information and criticism, that this report is respectfully submitted.

John Howatt,
G. L. Larson,
S. R. Lewis,
E. N. McDonnell,
W. M. Sawdon,
J. H. Walker,
W. L. Fleisher, *Chairman*,
GUIDE PUBLICATION COMMITTEE.

H. L. Alt said that THE GUIDE represents the collective opinion of the Society on the matters contained and urged that great care be taken to scrutinize every subject prepared for publication and also that the arrangement and make up of THE GUIDE should remain unchanged as far as possible from year to year.

E. K. Campbell expressed the opinion that the Society is so accustomed to having men give their time, energy and money for the benefit of all, that the work of technical committees is often taken for granted. He therefore, proposed that some recognition of the personal effort and sacrifice made by Mr. Fleisher in carrying on THE GUIDE work through a most critical period of the Society's history be given and he introduced a resolution of thanks which was seconded by Mr. Alt and unanimously carried.

On motion, the report of the Committee was accepted and made a part of the records.

A paper prepared by Prof. L. B. Loeb on the Nature of Ions in Air and Their Possible Physiological Effects was presented by Dr. G. R. Wait. (Complete paper published in October 1934 Journal Section, *Heating, Piping and Air Conditioning*).

A written discussion on this paper was given by W. H. Lehmberg; J. H. Walker read the prepared discussion of Dr. Snyder, Medical Department of Detroit Edison Co.; J. J. Aeberly gave a written discussion and one prepared by R. P. Cook, Rochester, was presented. Others who participated in the joint discussion were Dr. C.-E. A. Winslow and Messrs. Aeberly, Thompson, Fleisher, Dr. Hill and Dr. Wait.

Dr. G. R. Wait was again introduced by President Haynes and said that the paper, entitled Large-Ion and the Small-Ion Content of Air in Occupied Rooms, represented the results obtained at the Laboratory of Carnegie Foundation, Washington, D. C. (Complete paper published in February 1935 Journal Section, *Heating, Piping and Air Conditioning*). With the aid of slides the author showed the results graphically and described the procedure of conducting the experiments. He also explained how small ions are formed and the sources of large ions. After a brief discussion the meeting adjourned.

FOURTH SESSION—

Tuesday, January 29, 1935, 2:00 P. M.

President Haynes called the meeting to order and introduced H. L. Alt, New York to give the first technical paper of the afternoon. Mr. Alt gave an abstract of his paper, entitled Sun Effect and the Design of Solar Heaters. (Complete paper published in February 1935 Journal Section of *Heating, Piping and Air Conditioning*).

L. A. Harding commented on the practicability of using solar heating in the south and he touched on one or two points not included in the paper and stated that very high temperatures could be obtained by proper construction of solar heaters. Thomas Chester, Detroit, described the method of using solar heat for cooking purposes.

First Vice-Pres. John Howatt took the chair and announced that the next paper for consideration was The Thermo-Integrator—A New Instrument for the Observation of Thermal Interchanges by Dr. C.-E. A. Winslow and Dr. Leonard Greenburg. (Complete paper published in January 1935 Journal Section, *Heating, Piping and Air Conditioning*).

Dr. Winslow made the presentation and described the four environmental conditions which affect heat transfer through the human body and commented on some of the instruments which have been devised to measure one or more of these factors and then described the experimental work undertaken to produce an instrument with a wide range of recording capacity. With the aid of slides Dr. Winslow gave a complete description of the new instrument and its uses.

In the discussion Professor Fahnestock spoke about the use of the eupathescope and asked Dr. Winslow about the use of a new instrument in a rather cool environment. Mr. Harding commented on the difficulty of devising an instrument to register sensations of comfort. At the conclusion of the discussion Chairman Howatt expressed the thanks of the Society to Dr. Winslow for his paper.

The next paper on the program entitled A Laboratory Study of Minimum Ventilation Requirements—Ventilation Box Experiments by W. H. Lehmberg, A. D. Brandt and Kenneth Morse, was given by one of the authors, Mr. Lehmberg. (Complete paper published in January, 1935 Journal Section, *Heating, Piping and Air Conditioning*). Mr. Lehmberg explained the purpose of the study which was reported and gave the results on the three factors which were considered: (1) the relation between odor intensity and air flow in occupied spaces, (2) the factors influencing odor intensity and (3) the possibility of using odor intensity as a criterion of minimum air requirements. Comments on this paper were offered by Dr. E. V. Hill, Chicago, L. A. Harding, Buffalo, Thomas Chester, Detroit, Dr. C.-E. A. Winslow, New Haven, W. L. Fleisher, H. L. Alt, W. H. Driscoll, of New York, and Dr. G. R. Wait, Washington, D. C. At the conclusion of the discussion a reply was made by Mr. Lehmberg. Chairman Howatt complimented the author for his interesting presentation and stated that the paper was one resulting from cooperative research between Harvard University and the Society.

W. H. Driscoll, Chairman of the Committee on Ventilation Standards reported informally for the Committee. He stated that the Committee was marking time because of the project of wide scope undertaken by the *American Standards Association*, which had created a committee representative of many engineering and scientific bodies which would consider the general subject of ventilation standards. The work of this Society in taking the leadership to create a set of standards has received general commendation. At present, the *A. S. A.* Committee on Fundamentals is hard at work and the Society's Committee feels that nothing should be done at this moment to amend or change the Society's Code.

Many members of the Society are serving on this large *A. S. A.* group but no attempt is being made to force the Society's Standards on this larger group that has reviewed and will give full consideration to all of the facts relating to ventilation.

The Society's Committee has been asked by the Council to do some work on the question of definitions and a meeting will be called shortly to give this matter consideration. At that time, it is hoped that a preliminary report from the *A. S. A.* will be available and that for the next Annual Meeting this committee can report to the Society more comprehensively on any modifications of its standards that may be deemed desirable.

FIFTH SESSION—

Wednesday, January 30, 1935, 10:00 A. M.

Immediately after calling the session to order President Haynes introduced Arthur M. East, Associate Director of the Federal Housing Administration to outline the results of the modernization of Building Campaign.

The speaker pointed out that hundreds of communities have adopted the modernization of building plans of the Federal Housing Administration. The results are no longer theoretical, they are producing business and creating payrolls for the building industry and those engaged in it. A significant fact is that for every building mechanic put on the payroll eventually four people are removed from the relief rolls.

The better housing campaign sponsored by the Federal Housing Administration is a great peace time effort to make the American people home conscious. To direct this work over 1,000 people have been brought together in Washington to produce the material for the clip sheets, news notices, posters and booklets that are being distributed. In the field, there are a group of regional directors, state and district directors and in each district office, there is an experienced merchandising executive known as an associate director of modernization development. Each office has a definite quota of business to produce and Administrator James A. Moffett says, "I want $1,000,000,000 worth of insured loans in local capital loaned in the United States by the end of December, 1935."

The quota for the State of New York is $112,000,000. In the Western section of 20 counties with a population of somewhat over 2,000,000, it is desired that $22,000,000 of insured loans be placed in the local banks.

The Better Housing Campaign, said Mr. East, is a commercial venture to create sales of building materials, equipment and services and is being carried on by the use of the U. S. Government's prestige through local bet-

ter housing campaigns. A chairman is selected in each community and that chairman is requested to choose committees that will work. These committees are assisted through the Federal Housing Administration office and the work of the local campaign is coordinated with the emergency relief work. Training courses are held for district workers and weekly dealer contractor meetings are sponsored immediately after property owners' canvass has been made.

With a great peace time organization bringing a sales message to the public, the profession of heating, ventilating and air conditioning has the cooperation of Uncle Sam in providing tremendous credit facilities for modernization work. At the beginning of 1935 over 6,000 commercial banks made loans under the Federal Housing Administration plan and the building industry has many profitable years ahead. A long list of statistics could be quoted to prove this, said Mr. East.

There are some very definite things that men in mechanical lines can do and profit by the results of the paint and varnish industry campaign in 1921. People in the building industry and allied fields could put air conditioning in their own homes, adopt modern heating, ventilating and other devices for comfort. Then the building industry would get back on its feet rapidly.

The Federal Housing Administration asks the building industry to cooperate in this campaign and invites each manufacturer, engineer architect, jobber and contractor to recognize that the better housing campaign is a ready made promotion plan that will work. The building industry has a splendid opportunity for profitable business today.

President Haynes complimented Mr. East on his very fine presentation and then described one of his own personal experiences in securing a housing loan to repair defective chimneys.

In the discussion, comments were made by Messrs. Sharp, Jamestown, N. Y., Sawhill, Chicago and President Haynes.

Vice-President John Howatt took the chair and called for the first technical paper of the session, The Heat Requirements of Buildings by J. H. Walker and G. H. Tuttle. (Complete paper published in December 1934 Journal Section, *Heating, Piping and Air Conditioning*).

Mr. Walker pointed out that this paper represents part of the work of the Technical Advisory Committee on Heat Requirements of Buildings and consists of a statistical study based on data collected by the *National District Heating Association.*

P. D. Close, Chicago, presented a written discussion and G. B. Helmrich, Detroit read a prepared discussion submitted by Prof. F. B. Rowley, Minneapolis. Oral discussions were contributed by Messrs. Boyden, Boston, Harding, Buffalo, Buenger, St. Paul, Trump, Philadelphia and response to the questions was made by Mr. Walker.

The next paper entitled Tests of Three Heating Systems in an Industrial Type of Building by G. L. Larson, D. W. Nelson and John James was presented by Mr. James. (Complete paper published November 1934 Journal Section, *Heating, Piping and Air Conditioning*).

The author explained that the purpose of the paper was to present results of tests conducted on three distinct types of systems for a particular style of industrial building. The work was conducted at the University of Wisconsin and in cooperation with the Research Laboratory of the Society. A number of questions were asked by Messrs. Walker, Detroit, Sawdon, Ithaca, Boyden, Boston, Trump, Philadelphia, Houghten, Pittsburgh.

Mr. James explained that the results of the tests were not conclusive but studies would be continued during the current year to obtain additional data. Prof. Larson then outlined in greater detail the plan for continuation of the work. Three written discussions on the subject by Messrs. Arnold, Moulder and Seelig were read by the Secretary, A. V. Hutchinson.

The progress report of the Committee on Code for Testing and Rating Convectors of which R. N. Trane is Chairman was read by Albert Buenger, St. Paul.

Report of Committee on Code for Testing and Rating Convectors

The work of this Committee has been quite limited this year in view of the fact that two codes have already been adopted by the Society, one for the testing and rating of convectors for steam and the second for hot water.

It has been the purpose of the Committee to cooperate in every way to make these codes of importance to the industry. We are very glad to report that the N.R.A. Code for Testing and Rating of Convectors includes a clause which states that all manufacturers must test and rate their convectors in accordance with the A.S.H.V.E. Code. This industry, through its Code Authority, has required all manufacturers to have their convectors tested and rated by the Frost Laboratories, and these ratings will be published by all manufacturers on September 1 in their catalogs and will be used as a basis for pricing.

As soon as the steam ratings have been put into use, this Committee will endeavor to have the hot water code similarly adopted.

This Committee is endeavoring to be alert to see that any recommendations for changes of the Code are promptly given to the Society. At the present time (Aug. 1934) we are considering modifying our formula, by which the conversion factor exponent of 1.3 is changed to 1.5, which has been found to be a little more accurate and very close to the average of the tests made at the University of Illinois for the purpose of substantiating the correctness of the 1.3 factor.

Supplementing the report of Aug. 20, your Committee recommends that the exponent 1.3 shown in the correction factor formula in Paragraph 27 of the Hot Water Code and in Paragraph 28 of the Steam Code be changed to 1.5.

This change is brought about as the result of a large series of tests run at the University of Illinois, indicating that the factor of 1.3 is too low and that the factor 1.5 is very close to the average obtained in the series of tests.

We are pleased to report that in the N.R.A. Code the following has been inserted:

"On and after September 1, 1934, all ratings of performance of concealed radiators shall be in accordance with the Code for Testing and Rating Concealed Radiators as established by the American Society of Heating and Ventilating Engineers.

"Your Committee has cooperated with the *Concealed Heater Association* and we have been advised that all manufacturers belonging to the Association have had their units tested in an independent laboratory and that by February 1 all their convectors will be rated in accordance with the tests so obtained.

"These manufacturers are rating their units by the Steam Code only, and it will be the purpose of your Committee to continue

their work so that the Hot Water Code may also be adopted as a universal practice."

R. N. Trane, *Chairman*,
E. H. Beling, J. H. Holbrook
R. F. Connell, Hugo Hutzel,
M. Dillman, A. P. Kratz,
W. Ewald, M. G. Steele,
O. G. Wendel

COMMITTEE ON CODE FOR TESTING AND RATING CONVECTORS.
January 14, 1935.

Chairman Howatt then introduced E. D. Strickland, Secretary of the *Buffalo Engineering Society* who responded briefly.

SIXTH SESSION—

Wednesday, January 30, 1935, 2:00 P. M.

President Haynes opened the final session of the 41st Annual Meeting and called upon Prof. W. M. Sawdon, Chairman of the Publication Committee to present the report of his Committee.

Report of the Publication Committee

Article B-VIII, Section 7 of the By-Laws, lays upon the Publication Committee the duty of reviewing all papers intended for publication by the Society and also approving for publication the TRANSACTIONS of the Society.

Twenty-three papers, offered for publication, have been reviewed by the Committee and eighteen of these approved. Five papers were not considered suitable for publication by the Society. All material placed in the hands of the Committee has been acted upon.

Of the eighteen papers approved ten have already appeared in the JOURNAL, four of the ten having been presented at the Summer Session at Buck Hill Falls.

No action has been taken by the Committee on material for the TRANSACTIONS.

Respectfully submitted,
M. C. Beman,
A. P. Kratz,
W. M. Sawdon, *Chairman*,
PUBLICATION COMMITTEE.

January 13, 1935.

The report was accepted and made a matter of record.

Report of Meetings Committee

The Meetings Committee performed its routine functions of looking over the proposed meeting programs and advising as to their make-up. The Committee held no actual meetings, being able to transact all of its business by letter. Practically all of the work of soliciting papers and making up programs was done by the Secretary's office, the Meetings Committee acting only in an advisory and approving capacity.

At the suggestion of the Secretary, the Committee undertook to establish contact with several European members of the Society, with the view toward securing material for what might be termed a "symposium" on hot water heating or air conditioning practice. The thought was that a type problem would be presented to several European engineers for them to furnish their solution, in the form of a paper, and at the same time have an American engineer solve the problem according to approved American practice. Due to the difficulty of conducting such a project by foreign mail, as well as to language difficulties and the inability to lend the personal urge that is so often necessary to secure contributions, the project did not reach fruition. However, contact has been established with several European engineers, and the idea introduced to them, so that another year may possibly see its accomplishment.

We believe that the coming Meetings Committee should attempt to carry this idea out.

Respectfully submitted,
F. E. Giesecke,
L. W. Moon,
W. E. Stark, *Chairman*,
MEETINGS COMMITTEE.

President Haynes then called upon W. T. Jones, past president of the Society to conduct the installation of officers. The President-Elect John Howatt, Chicago, was presented by Dr. E. Vernon Hill; First Vice-President, G. L. Larson, Madison, was introduced by W. H. Carrier; Second Vice-President, D. S. Boyden, Boston, was introduced by L. A. Harding. The members of the Council were presented by W. H. Driscoll and regret was expressed that A. J. Offner, newly elected Treasurer could not be present because of an accident which resulted in a broken leg and his confinement to a hospital in New York.

In a brief tribute to the newly installed President, J. P. Fleming, Chicago, brought a message of greeting and good wishes from the 500 engineer custodians of the public schools of Chicago over whom Mr. Howatt has supervision.

President Howatt thanked Mr. Fleming for his message and the pledge of support and then announced the last technical paper, entitled, Study of Summer Cooling in the Research Residence for the Summer of 1934, A. P. Kratz, S. Konzo, M. K. Fahnestock and E. L. Broderick. (Complete paper published in January 1935 Journal Section, *Heating, Piping and Air Conditioning*).

Prof. Kratz made the presentation with the aid of slides and described the work carried on during the third summer of operation of the plant. A prepared discussion was presented by G. B. Helmrich, Detroit and then questions were asked by E. A. Jones, Milwaukee, A. Buenger, St. Paul, and W. L. Fleisher, New York.

President Howatt announced that at the organization meeting of the Committee on Research on Monday Prof. A. P. Kratz had been elected Chairman and J. H. Walker, Vice-Chairman for 1935.

W. H. Driscoll expressed the thought that many of those who had come to Buffalo to attend the meeting and at the same time attend sessions of manufacturing groups and code authorities, had been disappointed that they could not be present at more of the technical sessions. It was suggested that a friendly effort be made to have these outside meetings arranged at times that would not conflict with sessions of the Society.

W. A. Russell, Kansas City, presented a group of resolutions expressing the thanks of the Society to all who had contributed to the good time that had been enjoyed in Buffalo. J. J. Aeberly moved the adoption of the resolutions and after being properly seconded they were passed by a rising vote.

In closing the meeting President Howatt said that the local chapter had done a splendid job in arranging such a successful meeting and also expressed his appreciation to the authors of papers for the fine presentation of their data.

The meeting then adjourned.

Entertainment Events at Buffalo

AN enjoyable three days was spent by members of the Society in Buffalo during the 41st Annual Meeting at Hotel Statler. With a registration of 350 members, guests and ladies, the Committee on Arrangements directed by Chairman M. C. Beman and assisted by Roswell Farnham, Vice-Chairman, were gratified with the enthusiastic response that attended their efforts.

The initial social event occurred on Sunday afternoon January 27 when Mr. and Mrs. C. W. Farrar entertained the members of the Council and the Local Committee at their home, 29 Oakland Place. From 5:00 to 7:00 p. m. 68 members and their wives enjoyed the musicale and supper at the Farrar home. A group of talented Buffalo musicians rendered a variety group of selections of both classical and popular type. The artists were Esther and Ephraim Rabiroff who gave several classical selections. A group of numbers was sung by Lorenzo accompanied by Margaret Dana, piano, and William Schimpf, violin, and Audrey Ely who was accompanied by Joseph Armbruster.

On Monday evening, January 28, a Get-Together Dinner was held in the main dining room of the Hotel Statler and a special menu was served to 276 members and guests who were present. Dinner and dancing to the music of Lloyd Huntley's Orchestra was enjoyed by the group and at 8:30 they assembled in the Terrace Room for the special broadcast presentation of the *Buffalo Times*. This variety show of an hour's duration was most enjoyable as was attested by the hearty applause. After the broadcast many returned to the main dining room for informal dancing. D. J. Mahoney and his Entertainment Committee were responsible for the arrangements.

On Tuesday, January 29 at noon, the ladies assembled for an auto trip to the Park Lane Hotel where luncheon was served and a card party followed. The winners were Mrs. J. P. Fleming, Mrs. C. H. Love, Mrs. Thomas Chester, Mrs. C. W. Stewart, Mrs. V. P. John, Mrs. Barclay Newall, Mrs. Wattenberg, and Mrs. Lou Murray. The host and hostess on this occasion were Mr. and Mrs. Park Hedley who were in charge of arrangements for this party.

Members of the Nominating Committee assembled for luncheon on Tuesday, January 29 and organized for 1935. E. A. Jones was elected Chairman and R. J. Tenkonohy, Secretary.

The past presidents' luncheon was held at 1:00 p. m. on Tuesday and those in attendance were Messrs. Carrier, Driscoll, Harding, Hill and Jones.

Promptly at 7:30 p. m. in the evening, 286 members and guests assembled for the Annual Banquet in the Ballroom of the Hotel Statler. Just as the group sat down a radio broadcast was tuned in and the familiar voice of W. H. Driscoll, past president of the Society, was heard and his brief talk on Air Conditioning in the Home was a novel introduction to the evening's festivities.

At the conclusion of dinner, Toastmaster L. A. Harding expressed the desire that quiet prevail so that the dropping of a pin might be heard and at that point, a pin of mammoth size was released and it was evident to the audience that any one within a quarter of a mile would have been aware of the dropping of the pin.

In a brief and graceful tribute to the service of Mr. Haynes as President, W. H. Carrier presented him with the past president's emblem after which Mr. Haynes expressed his appreciation.

The President-Elect John Howatt, Chicago, was introduced by the toastmaster and he responded briefly. The members of the Committee on Arrangements were introduced and the audience applauded for the work that they had done to make the meeting an outstanding success.

The toastmaster then started his introduction of the speaker of the evening, the eminent Dr. Walter E. Traprock and much to everyone's surprise the Doctor had disappeared from his place at the speakers' table but appeared in the nick of time from among the audience.

His discourse was on Looking Into the Stratosphere and he told many intimate details of his experience and research which had been materially aided by prominent members of the Society. The audience found Dr. Traprock's theories of heating, ventilating and air conditioning highly entertaining and enjoyed the anecdotes that he recalled from his varied career in scientific research.

During the dinner musical numbers were played by Misses Gomph and Workman. At 10:00 p. m. the orchestra directed by Charles Seelbach played for dancing which was enjoyed until after 1:00 o'clock.

During their stay in Buffalo, many of the ladies visited the Albright Art Gallery, Niagara Falls and other points of interest.

During the week of January 27, the work of the Society received prominent notice in the columns of the local press, indicating great public interest in the subjects discussed at the technical sessions. In addition, out of town papers carried stories about

The special broadcast, January 28, in honor of A. S. H. V. E.

Society activities so that the work of the Publicity Committee directed by C. W. Farrar was especially effective.

At a luncheon meeting of the Lions Club of Buffalo in the Hotel Statler, W. H. Driscoll, New York was the featured speaker and told his audience some of the interesting sidelights of big building construction.

Council Meetings at Buffalo

On January 30, the organization meeting of the 1935 Council was held in the Hotel Statler, Buffalo, with President John Howatt in the chair. Appointment of the four Council Committees was announced, also personnel of several special committees.

The Council approved an award of the F. Paul Anderson Medal in 1935 and the membership of the Committee on Award consists of Prof. G. L. Larson, *Chairman*, H. P. Gant, L. A. Harding, S. R. Lewis and W. E. Stark.

Depositories for Society funds were selected and A. V. Hutchinson was appointed Secretary.

The Budget for 1935 was adopted calling for income of $59,633.24 and expenditure of $58,650. Other matters discussed were cooperation with local chapters, distribution of THE GUIDE 1935, renewal of headquarters office lease and the appointment of a Technical Assistant.

After some discussion the invitation of the Ontario Chapter to meet in Toronto in the summer of 1935, was accepted and the dates selected are June 24 to 26.

The final meeting of the old Council was held in Hotel Statler January 27 with C. V. Haynes presiding and among the actions taken, were the appointment of an Advisory Exposition Committee and the approval of reports of Officers and Special Committees for presentation at the Annual Meeting sessions.

Life membership was conferred upon Messrs. T. E. Crone, A. M. Feldman, W. T. Hopson, R. H. Thomas, J. J. Liner, W. H. McKiever and C. E. Monday, and a telegram of congratulation and greeting was sent to Mr. and Mrs. H. B. Gombers who celebrated their 50th wedding anniversary January 29.

Reinstatement of six members was voted, 21 resignations were accepted and revisions in the Philadelphia Chapter Constitution and By-Laws were approved.

President Howatt Will Visit Chapters

President John Howatt left Chicago on March 5 for an official visit to local chapters of the Society in the Middle West and on the Pacific Coast. He will speak in St. Louis March 6, Kansas City March 7, Los Angeles March 11, and will confer with members in San Francisco March 12. The Pacific Northwest Chapter at Seattle will greet President Howatt March 14 and he will be with the Minnesota members in Minneapolis March 18 and speak to the Wisconsin Chapter members in Milwaukee March 19.

In April his itinerary includes meetings at Toronto April 8, Buffalo April 9, Boston April 10, Philadelphia April 11, New York April 15 and Cincinnati April 16.

Prof. Larson Speaks at Air Conditioning Institute

Prof. G. L. Larson, Madison, Wis., vice president of the Society was the guest speaker at the dinner of the General Electric Air Conditioning Institute held in Schenectady, January 25. G. B. Warren of the turbine department, a former pupil of Prof. Larson at the University of Wisconsin, welcomed him and D. W. McLenegan, asst. mgr. of the Air Conditioning Institute introduced the speaker to those attending the dinner. During his talk, Prof. Larson outlined the history of the AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS and told how the Society had contributed to the fundamental knowledge of the art of heating, ventilating and air conditioning.

The General Electric Institute was conducted for a period of several weeks January 14 to February 16 for dealers and distributors in 33 states. The Institute had an attendance of 250 and was directed by Elliott Harrington.

South Interested in Air Conditioning

On February 13 W. H. Carrier, president of the Carrier Engineering Co. and a past president of the A.S.H.V.E. and *A.S.R.E.* was guest speaker at a joint meeting, sponsored by the Atlanta, Ga., chapters of the *A.I.E.E.* and *A.S.M.E.*

The subject of Mr. Carrier's talk was Modern Air Conditioning and a large audience of engineers, architects and others connected with the construction industry of Atlanta attended the meeting which was held in the auditorium of the O'Keefe Junior High School.

A meeting sponsored by the Air Conditioning Council of South-eastern Florida on February 15 was held at the Miami Biltmore Country Club. H. W. Ferguson presided at this open meeting and dinner which was attended by a large audience of engineers, laymen and students interested in the subject of air conditioning.

President Howatt Honored by 1400

Approximately fourteen hundred Society, Board of Education and other associates of John Howatt, President of the A. S. H. V. E. and Chief Engineer of the Board's Bureau of Engineering, assembled at a banquet in the Grand Ballroom of the Hotel Sherman, Chicago, the evening of February 28 to honor Mr. Howatt and his election as National President of the Society. Hosts were the members of the local union of the International Union of Operating Engineers, and the guests included the President and Members of the Board of Education, heads of the Board's bureaus, Mayor Edward J. Kelly, State's Attorney Thomas J. Courtney, and officers and members of the unions concerned with the operation and maintenance of the Chicago schools. James J. Spain, President of Local 143-143B of the operating engineers' union, acted as toastmaster, and Reverend James P. Kiely gave the invocation.

The A. S. H. V. E. was represented by four Past-Presidents living in Chicago—John F. Hale, H. M. Hart, Dr. E. Vernon Hill, and Samuel R. Lewis—by the officers of the Illinois Chapter, and by Prof. G. L. Larson, First Vice-President of the Society.

A letter from Dr. A. C. Willard, President of the University of Illinois, and a Past President of the Society, felicitating Mr. Howatt and regretting his own inability to be present in person to do so, was read, as were telegrams and letters from many other prominent persons.

The speakers included Mayor Kelly, Jacob G. Bennema, Col. Howard P. Savage, Robert D. Gregg, Richard S. Folsom, James B. McCahey, President of the Board of Education, John B. Christensen, Mrs. William S. Hefferan, William L. McFetridge, Ernst Buehler, Robert J. Tormey, Professor Larson, Charles E. Driscoll, Joseph J. Salat, Reverend Kiely, Irwin Walker, Martin P. Durkin, Paul Drymalski, Victor A. Olander, and State's Attorney Courtney.

The speakers reviewed "The Chief's" twenty-one years of service to the Board of Education, his abilities, and his accomplishments. Most of the speakers have known Mr. Howatt for many years, and told of their associations with him, his fitness for the important position of president of a national society such as the A. S. H. V. E., and congratulated the Society on securing a leader of his qualifications. Prof. Larson described the founding, aims, and accomplishments of the Society.

President Howatt made the concluding address of the evening, stating that his friends at the speaker's table had built up a reputation for him that he felt was going to be hard to maintain in the days to come. He then discussed the importance of the engineer, the research work of the A. S. H. V. E., and spoke briefly on air conditioning.

Local Chapter Reports

Illinois

February 11, 1935. John Howatt, newly elected president of the A.S.H.V.E., was given a home-coming at the February meeting of the Illinois Chapter by 109 members and guests. An excellent dinner was served at 6:45 p.m., in the College Inn of the Hotel Sherman, Chicago.

The meeting was called to order at 8:15 p.m., by Pres. R. E. Hattis and the minutes of the January meeting were read and approved.

Two letters from President Howatt were read. The first requested that meeting notices of the Illinois Chapter be mailed to the other chapters. The second was the first of a series of monthly letters from President Howatt to Chapters, briefly outlining plans for the coming year and requesting the cooperation of every member.

J. J. Aeberly gave a short talk on The Need of a License Law for the Professional Engineer. He urged that effort be made by responsible engineers towards the enactment of a State license law and cited the benefits of such legislation. A short discussion followed.

S. R. Lewis mentioned the work of the committee in charge of the heating, ventilating and air conditioning section of Chicago's new Building Code.

The meeting, without further preliminaries, was placed in the competent hands of President Howatt. Mr. Howatt spoke of his appreciation for the loyal support of the Illinois Chapter and all of the A.S.H.V.E. members, of his realization that the coming year is to be a year of hard work and responsibility, and of his hopes that he may be a credit to the Society and to the Chapter.

In part, Mr. Howatt's talk was devoted to the present phase of the economic cycle, the N R.A., and the resumption of building construction. He discussed the term *air conditioning* and divided it into three branches: (1) for comfort; (2) for industrial processes; and (3) for health.

Mr. Howatt concluded his talk with a three-point expression of purpose: to establish standards of air conditioning; to stress health possibilities; and to strive for the recognition of the Society and its work.

After an enthusiastic vote of thanks to President Howatt for his excellent talk, the acting secretary, J. J. Hayes, gave a short report covering activities at the Buffalo Annual Meeting.

January 14, 1935. A dinner in the Old Town Room of the Hotel Sherman, Chicago, preceded the meeting of the Illinois Chapter, which was called to order by Pres. R. E. Hattis. The minutes of the previous meeting were read and attention was called to the Society's Annual Meeting at Buffalo.

The applications of E. T. Blaker and Paul Abrahamson for limited Chapter membership and that of F. J. Wilkinson for regular membership were acted upon favorably.

H. R. Linn performed the pleasant duty of presenting to W. B. Graves a certificate of Life Membership in the A.S.H.V.E. In his acceptance speech Mr. Graves recalled many interesting events in the early days of the Illinois Chapter.

John Howatt, First Vice-President of the Society, introduced S. Konzo, University of Illinois, whose subject was Forced Air Heating and Cooling in the Research Residence at Urbana.

Mr. Konzo described the plan and general construction of the house and outlined the type of heating system used. He gave much valuable data regarding proper register location, diffuser design and air velocities and emphasized the opinion that more attention should be paid to these installation factors.

The larger portion of the evening was devoted to a discussion of the summer cooling problem. Mr. Konzo outlined the results of many tests with artificial cooling during the day, supplemented by circulation of out-door air at night, also with no out-door air circulation at night, and only with out-door air circulation.

Mr. Konzo's excellent talk was followed by many questions and a lively discussion by numerous members and guests. The enthusiastic vote of thanks testified to Mr. Konzo's ability as an engineer and a speaker.

The meeting adjourned at 9:50 p.m.

Massachusetts

February 11, 1935. The regular monthly meeting of the Massachusetts Chapter was held at Massachusetts Institute of Technology and dinner was served in the Walker Memorial Dining Room at 6:15 p. m.

An inspection trip of the heating and ventilating apparatus in the new Field House and the laboratories of the Institute was enjoyed by the members and guests present.

W. T. Jones, Past President of the A.S.H.V.E., spoke briefly on the recent Annual Meeting of the Society in Buffalo.

Pres. R. S. Franklin of the Massachusetts Chapter told of the coming meeting at Filene's, Inc., where dinner will be served and the new air conditioning system will be inspected.

Prof. James Holt gave an interesting lecture on the Fundamentals of Humidification and Dehumidification. According to the report of Secy. W. A. McPherson, the discussion which followed attested to the interest of the subject.

Minnesota

February 11, 1935. Vice-Pres. C. E. Gausman called the meeting to order with 50 members and guests present. After the minutes of the previous meeting had been read, N. D. Adams extended an invitation, and favorable action was taken by the Chapter, to hold the May meeting in Rochester, Minn.

Albert Buenger, recently elected as a member of the Society's Council for a three-year term, gave a report on the Annual Meeting in Buffalo. He sketched the high lights of the technical sessions and gave many human interest side lights of the meeting. The proposed changes in the method of selecting representatives for the Nominating Committee were outlined.

M. S. Wunderlich, Nominating Committee representative of the Minnesota Chapter, also gave a report.

The principal speaker of the evening was H. F. Dever, who presented a paper on Controls as Applied to Air Conditioning. His talk was very thorough, covering in general the entire field of controls for this purpose, ranging from the most simple two-position type to the multi-position compensating type of regulator.

The meeting adjourned at 9:30 p.m. with an enthusiastic vote of thanks to Mr. Dever for his interesting paper, according to the report of Secy. R. E. Backstrom.

January 14, 1935. The meeting was presided over by Vice-Pres. C. E. Gausman and the principal speaker was Prof. A. B. Algren, University of Minnesota.

Professor Algren gave a paper on Oil Burners and Their Application to Domestic Heating, which was exceptionally interesting and well illustrated with curves and supporting data obtained over a period of months through a large number of tests on oil burners. Keen interest was shown on the part of members.

Sixty members and guests were present for dinner, while more than 70 heard the talk.

December 10, 1934. A regular meeting of the Minnesota Chapter was held at the Minnesota Union, when 43 members and

guests were present. Supper was served at 6:15 p.m., after which Vice-Pres. C. E. Gausman called the meeting to order. Minutes of the October meeting and comments on the annual fall party in November were read and approved.

A letter from Secretary Hutchinson called attention to action taken by the Council, continuing the reduced rate of annual dues and waiving initiation fees for the year 1935.

The speaker of the evening was R. N. Trane, LaCrosse, Wis., who gave a talk on the subject of Extended Surfaces for Cooling Using Cold Water or Direct Expansion. This highly technical subject was ably handled and everyone who heard Mr. Trane was deeply grateful for this important information in an almost unexplored field.

New York

February 18, 1935. Talks on pre-fabricated houses and protecting real estate equities featured the February meeting of the New York Chapter, held at the Building Trades Club. About 50 members and their guests were present when the meeting was called to order by Pres. H. W. Fiedler.

A Completely Air Conditioned Home for $3,800 was the subject of D. C. Slipher, who told of the work being done to develop a low cost, pre-fabricated house. The $3,800 house, which will be sold on time payments for $38.00 a month with no down payment, will have two bedrooms, a living room, kitchen and bath. The principal feature of the house will be the moto-unit, placed between the bathroom and kitchen and which contains all of the mechanical equipment of the building. A combination of aluminum foil and fibrous insulation will be used to reduce the heat loss of the house and insure low cost housing and cooling. The buyer will be able to specify the type of fuel, either coal, oil, gas, or electricity.

Protecting Real Estate Equities was discussed by the next three speakers from three radically different angles.

B. J. Gillroy, formerly with the Home Owners Loan Corp., told how the Federal government is protecting real estate values.

O. O. Oaks spoke of the work of the manufacturers in promoting modernizing campaigns to increase values of buildings.

D. J. Purinton explained how banks have been affected by the low real estate values and what their attitude is in respect to the use of modernizing for increasing values, concluding the subject.

Ontario

February 4, 1935. Forty-two members and guests were present at the regular meeting of the Ontario Chapter held at the Royal York Hotel. Following dinner, the minutes of the previous meeting were read and accepted.

Pres. W. R. Blackhall called upon H. S. Moore to introduce the principal speaker of the evening, W. C. Kelly, who spoke on Boilers and Boiler Settings.

A discussion followed and M. W. Best extended a vote of thanks to Mr. Kelly on behalf of the Chapter.

President Blackhall announced that Toronto had been selected for the Semi-Annual Meeting of the Society in 1935 and called a special business meeting to discuss arrangements.

It was voted that the Board of Governors act as a Nominating Committee to make a preliminary survey of committees and that the Board appoint committee chairmen immediately.

Philadelphia

January 10, 1935. Pres. W. P. Culbert called the annual meeting to order at the Engineers Club, following dinner. The minutes of the previous meeting were read and approved.

The treasurer's report was read and approved with enthusiasm as it showed a cash increase of $110.00 over the annual report of 1933.

President Culbert made an announcement in connection with the Society's Annual Meeting in Buffalo and requested as many members of the Chapter to be present as possible.

L. P. Hynes, chairman of the Auditing Committee, reported that the books had been audited and found correct.

A number of changes in the Constitution were presented to the Chapter at the December meeting and, notice having been duly sent to all members by mail, were then voted on. A motion that the changes be adopted was carried and this matter was ordered referred to the Council of the Society for approval at the Annual Meeting.

The election of Officers and Board of Governors was then presented and upon motion duly seconded, the secretary was instructed and cast a unanimous ballot for the membership for the following Officers and Board of Governors:

President—J. H. Hucker.
Vice-President—W. R. Eichberg.
Secretary—H. H. Erickson.
Treasurer—E. N. Sanbern.
Board of Governors—W. P. Culbert, S. E. Plewes, R. F. Hunger.

Retiring President Culbert presented the new president, Mr. Hucker, following a short, interesting talk on the past year's activities. President Hucker then assumed his duties and gave a brief outline of his contemplated activities, stressing the necessity for securing new members.

Past President Culbert was presented with a handsome suede jacket as an expression of the esteem of the membership.

The program was then turned over to the chairman of the Meetings Committee, A. C. Caldwell, and the Boy's Minstrel Team of Germantown Boy's Club gave a very interesting show. This club is for underprivileged boys in the Germantown area, whose ages range from 4 to 15 years, and their entertainment was voted the best ever presented before the Chapter. As this club is financed by the Welfare, a collection was taken amounting to approximately $60.00.

The next feature was presented by Mr. Caldwell and the membership was amused and entertained by Ed. Wilson, amateur magician.

The meeting was turned back to President Hucker, who on motion adjourned the meeting.

St. Louis

February 12, 1935. A dinner and meeting at the Kingsway Hotel was called to order by Vice-Pres. C. R. Davis and the minutes of the January meeting were approved.

Secy. A. L. Walters read a letter in behalf of H. V. Bayse and also relayed Pres. J. W. Cooper's verbal appreciation for flowers.

The secretary then read Pres. John Howatt's monthly letter and R. J. Tenkonohy gave a comprehensive report of the Annual Meeting. Treas. E. E. Carlson reported a balance of $333.64.

G. W. F. Myers, chairman of the Program Committee, reported that the meetings had been arranged to May and outlined the programs, calling particular attention to President's Night, March 9, in honor of President Howatt of the A.S.H.V.E.

Mr. Carlson, as chairman of the Entertainment Committee, told of tentative arrangements for the June party.

After a short recess, H. D. Euwer gave an illustrated talk on Application of Air Conditioning to Railway Cars, which was followed by a lively discussion, much enjoyed by the 30 members and guests present.

January 8, 1935. Following dinner at the Kingsway Hotel, with 27 members and guests present, Pres. J. W. Cooper called the meeting to order.

President Cooper reported action of the Board of Governors in regard to dues and it was moved, seconded and carried that the Chapter accept the recommendation of the Board and fix the dues at $4.00 per year for members and $4.00 per year for limited Chapter members.

Secy. A. L. Walters read a communication from headquarters office telling of the election of J. E. Manahan and L. F.

Woodman to membership and also read a letter in regard to the Annual Meeting at Buffalo.

The chairman of the Program Committee, G. W. F. Myers, outlined tentative plans for future meetings and advised of an invitation received from the Ranken School to hold one of the Chapter meetings there.

C. R. Davis reported the application of V. E. Hugoniot. E. E. Carlson, chairman of the Entertainment Committee, asked that suggestions be sent him by members as to suitable entertainment to be arranged.

The chairman of the Educational Committee, Mr. Davis, called on G. B. Rodenheiser, who outlined the programs for the Second Open Forum on Air Conditioning.

C. E. Hartwein, chairman of the Auditing Committee, read the committee's report.

A. J. Lindsay was introduced by Mr. Myers and gave an illustrated talk on Oil Burners and Their Application to Air Conditioning Units.

After a rising vote of thanks to Mr. Lindsay, the meeting adjourned.

Pittsburgh

February 11, 1935. On this occasion two inspection trips took the place of the customary monthly technical program and had the large attendance of 125 members and guests.

The first trip, which started at 7:45 p.m., was through the new Pittsburgh Post Office and Federal Court Building. The party was first taken to the offices of the Weather Bureau, where the Bureau's many instruments were shown. Some of the fans which supply air for the ventilation of the court rooms were inspected, as well as the temperature control equipment. The party was then taken to the machinery rooms in the sub-basement, where the vacuum pumps, house pumps, fire pump, refrigeration compressors, sump pumps, and sewage ejectors were located. The program clock and the remote control switchboard for the operation of zoning valves in the heating system were also examined.

The trip through the building afforded an opportunity to watch the various pieces of mail handling equipment in operation.

Leaving the Post Office at 9:15 p.m., the group journeyed to the new studios of radio station KDKA in the Grant Building. Here the visitors were shown through several of the studios and H. M. Redding explained the method of applying sound insulation material to the walls, floors, and ceilings of the rooms and the ducts of the air conditioning system.

Secy. T. F. Rockwell reports that afterwards many members of the party sat as part of the audience during the rehearsal and broadcast of the Pittsburgh Varieties, while the remainder inspected the air conditioning machinery, which provides for all functions of year-round conditioning.

Southern California

January 8, 1935. At the January meeting the speakers were R. L. Stanley and W. E. Campbell. Twenty-two members and guests were present showing an increase in attendance.

Mr. Stanley discussed gas furnaces and their development during the past several years. Mr. Campbell told of the use of hot water heating for homes, by means of concealed radiation, and pointed out its practical points for a climate such as that of Southern California.

Both of the discussions were enlightening and greatly appreciated by members and guests.

December 18, 1935. At the last meeting of the Southern California Chapter in 1934, 17 members and guests were present, and W. E. Barnum, newly elected president, presided. Secy. P. C. Scofield recorded the minutes.

Arthur Hess gave a very interesting talk on Comfort with Relation to Heating, Ventilating and Air Conditioning. Mr. Hess described in detail the functions of the human body, including its respiratory action and the way in which heat is given off at various atmospheric conditions. The speaker also explained how men are able to work at greater efficiency with the maintenance of certain atmospheric conditions.

Wisconsin

January 21, 1935. The January meeting of the Wisconsin Chapter was held at the Hotel Pfister, preceded by dinner.

Pres. Ernest Szekely requested that at the next meeting the question box plan be inaugurated, whereby members may submit for discussion questions on which they desire information. It was also suggested that L. A. Burch of the Program Committee arrange for the presentation of a report on one or more chapters of THE 1935 GUIDE as an additional feature of the monthly meetings.

At the conclusion of routine business, A. M. Wagner introduced H. R. Linn, Chicago, Ill., who was the speaker of the evening. Mr. Linn's talk on The Heating Salesman was timely, educational, and highly interesting, according to the report of Secy. G. E. Hochstein.

When the meeting adjourned at 10:00 p.m., members were free in expressing their feeling that the evening had been well spent.

Death of C. W. Christian, Life Member

Members of the Society and friends of Charles W. Christian will learn with regret of his death on January 31, 1935 at his home in Charlotte, N. C., following a year's illness. Throughout his life he had been actively connected with the heating and ventilating industry, both as an engineer and contractor. He joined the A.S.H.V.E. in 1913 and lived to enjoy the distinction of receiving Life Membership, which was conferred on him by the Council in October 1934.

C. W. Christian

Mr. Christian was born on March 9, 1863 in Castine, Maine, where he completed his schooling. He entered the heating business in Boston and spent the early part of his career in close association with many well known firms, including Walworth Co., Tucker & Sons, and Bradley & Chapman. For a period of years Mr. Christian operated in Boston under his own name.

In 1908 Mr. Christian moved to Charlotte, N. C., to take charge of the American Machine & Manufacturing Co.'s plants at Charlotte and at Greenville, S. C. When this company merged with the General Fire Extinguisher Co., Mr. Christian remained as Department Manager until 1923.

On March 1, 1923, Mr. Christian reentered the heating and ventilating business as an engineer and contractor in his own name and was in active charge until his death. Many of the outstanding heating installations in the South, from the Mason-Dixon line to the Rio Grande River, were made under his direction.

Mr. Christian is survived by his widow and two daughters, Miss Pauline Christian and Mrs. E. H. Brandt, Jr., of Charlotte, N. C., and three sisters residing in and around Boston, Mass.

CANDIDATES FOR MEMBERSHIP

The Constitution of the Society as now amended, requires the following mode of procedure in voting on applicants for membership in the Society. All applications for membership are to be sent to the Secretary and the names of applicants and their references shall be printed in the next issue of the JOURNAL of the Society or sent to the members in other approved manner as ordered by the Council. When replies are received from references, the Candidate's application shall be submitted to and acted upon by the Committee on Admission and Advancement as soon as possible.

When the Committee on Admission and Advancement has acted favorably upon a Candidate's application and assigned his grade, the Council shall vote upon the election of the proposed Candidate for membership by letter ballot. During the past month 29 applications for membership have been received and the names of these men and their sponsors are published in the following list.

Members are requested to scrutinize the list with care. The Committee on Admission and Advancement, and in turn the Council, urge the members to assume their share of the responsibility of receiving these candidates into membership by advising the Secretary promptly of any whose eligibility for membership is in any way questioned.

All correspondence in regard to such matters is strictly confidential, and is solely for the good of the Society, which it is the duty of every member to promote.

Unless objection is made by some member by March 15, 1935, these candidates will be balloted upon by the Council. Those elected to membership will be notified by the Secretary immediately after election.

CANDIDATES	*REFERENCES*	
BAKER, W. H., JR., Sales Engr., Crane Co., Chicago, Ill.	C. V. Haynes F. C. McIntosh	M. K. Fahnestock A. P. Kratz
BAUR, J. W., Student, University of Illinois, Urbana, Ill.	W. H. Severns P. E. Mohn *(A.S.M.E.)*	W. N. Espy *(Non-Member)* J. A. Polson *(A.S.M.E.)*
BLOOM, LOUIS, Co-Partner, Bloom Htg. Co., Brooklyn, N. Y.	H. W. Fiedler H. G. Meinke	W. M. Heebner G. E. Olsen
BOEHMER, A. P., Student, University of Illinois, Urbana, Ill.	W. H. Severns P. E. Mohn *(A.S.M.E.)*	W. N. Espy *(Non-Member)* J. A. Polson *(A.S.M.E.)*
COMPTON, W. E., Student, University of Illinois, Urbana, Ill.	W. H. Severns P. E. Mohn *(A.S.M.E.)*	A. P. Kratz S. Konzo
COOK, H. R., Mgr., American Foundry & Furnace Co., Milwaukee, Wis. *(Reinstatement)*	C. H. Randolph G. L. Larson	A. M. Wagner E. A. Jones
DAWSON, G. S., Merchandise Sales Engr., B. C. Elec. Rly. Co., Ltd., Vancouver, B. C.	Walter Leek R. E. Johnston	E. A. Wheatley *(Non-Member)* A. W. Givin
DEVER, H. F., Sales Engr., Minneapolis-Honeywell Reg. Co., Minneapolis, Minn.	L. B. Miller C. E. Lewis	L. L. Kuempel L. C. Gross
ENSIGN, W. A., Vice Pres., Frontier Fuel Oil Corp., Lakeview, N. Y.	P. S. Hedley A. R. Kamman	W. E. Voisinet J. J. Landers
FARBMAN, S. M., Student, Carnegie Inst. of Tech., Pittsburgh, Pa.	C. M. Humphreys T. F. Rockwell	H. F. Huettner O. A. Kennedy
FRISSE, J. L., Student, Carnegie Inst. of Tech., Pittsburgh, Pa.	T. F. Rockwell C. M. Humphreys	P. V. Kennedy D. C. Kellner
GAMBLE, C. B., Mgr., Air Cond. Dept., Frigidaire Corp., Buffalo, N. Y.	W. E. Voisinet J. J. Yager	B. C. Candee J. S. Snyder
GOODMAN, Daniel, Student, Carnegie Inst. of Tech., Pittsburgh, Pa.	C. M. Humphreys T. F. Rockwell	O. A. Kennedy G. W. Gault
GREINER, G. E., JR., Student, Carnegie Inst. of Tech., Pittsburgh, Pa.	C. M. Humphreys T. F. Rockwell	O. A. Kennedy H. F. Huettner
GROVES, S. A., Junior Salesman, American Radiator Co., New York, N. Y.	O. O. Oaks W. R. Zuhlke	F. B. Howell W. W. Timmis
HANSON, L. P., Engr., U. S. Air Cond. Corp., Minneapolis, Minn. *(Advancement).*	F. B. Rowley A. B. Algren	J. V. Martenis J. R. Hall
HOCHSTEIN, G. E., Sales Engr., Heil Co., Milwaukee, Wis.	C. H. Randolph Ernest Szekely	E. A. Jones G. L. Larson
KARTORIE, V. T., Grad. Asst. in Mech. Engrg., Case School of Applied Science, Cleveland, O. *(Advancement).*	G. L. Tuve A. O. Willey *(Non-Member)*	F. H. Vose *(Non-Member)* C. A. McKeeman *(Non-Member)*
KINGSLAND, G. D., Vice Pres., Minneapolis-Honeywell Reg. Co., Minneapolis, Minn.	D. S. Boyden L. B. Miller	W. E. Stark W. J. Hajek
KREZ, LEONARD, Sec., Paul J. Krez Co., Chicago, Ill.	John Howatt J. J. Finan	R. M. Getschow G. M. Getschow

LIGHTHART, C. H., N. Y. State Engr., Lakeside Co., Buffalo, N. Y.

MARIN, AXEL, Assoc. Prof. Mech. Engrg., University of Mich., Ann Arbor, Mich.

MEAKIN, J. B., Grad. Student, Mass. Inst. of Tech., Brighton, Mass.

MOELLER, ROBERT, Student, Case School of Applied Science, Cleveland, Ohio.

NEIS, W. A., Student, Carnegie Inst. of Tech., Pittsburgh, Pa.

TROSTEL, O. A., Kern Engrg. Co., Inc., Milwaukee, Wis.

WARDELL, ARTHUR, Partner, Thomas & Wardell, Toronto, Ont., Can.

WOLFERT, E. R., Section Engr., Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

WRIGHT, W. J., Senior Student, University of Ill., Urbana, Ill.

J. J. Yager
L. A. Harding

J. H. Walker
G. D. Winans

James Holt
C. I. Svenson

G. L. Tuve
F. H. Vose *(A.S.M.E.)*

C. M. Humphreys
T. F. Rockwell

C. H. Randolph
Ernest Szekely

M. F. Thomas
W. P. Boddington

F. C. Houghten
C. M. Humphreys

W. H. Severns
P. E. Mohn *(A.S.M.E.)*

A. R. Criqui
G. A. Voorhees

E. E. Dubry
G. H. Tuttle

H. C. Moore
C. W. Berry *(A.S.R.E.)*

P. E. Henke *(S.A.E)*
E. S. Ault *(A.S.M.E.)*

H. F. Huettner
O. A. Kennedy

E. A. Jones
G. L. Larson

G. A. Playfair
J. S. Paterson

P. Nicholls
T. F. Rockwell

W. N. Espy *(Non-Member)*
R. F. Larson *(Non-Member)*

Candidates Elected

In the past issues of the JOURNAL of the Society the names of the following men were listed as Candidates for Membership. The membership grade of each Candidate has been assigned by the Committee on Admission and Advancement and ballotted upon by the Council. We are now instructed by the Council to post herewith, as required by Art. B-III, Sect. 8, of the By-Laws, the following list of candidates elected:

MEMBERS

ALFAGEME, BRAULIO, Owner Mgr., Braulio Alfageme, Air Cond., Madrid, Spain.

GIANNINI, M. C., Faculty Lecturer, New York University, New York, N. Y.

HILDEBRANDT, H. A., Mfrs. Repr., Minneapolis, Minn. *(Reinstatement)*

HUGONIOT, V. E., Air Cond. Engr., Weber Implement & Auto Co., St. Louis, Mo.

JORDAN, W. D., Mgr. Air Cond. Div., Savage Arms Corp., New York, N. Y.

LAWLOR, J. J., Mgr., The Jas. Robertson Co., Ltd., Toronto, Ont., Can.

MACDONALD, J. D., Vice Pres., Dominion Radiator & Boiler Co., Toronto, Ont., Can.

MOODY, L. E., Member of firm, Isaac Hathaway Francis, Consulting Engrs., Philadelphia, Pa. *(Reinstatement)*

MOORE, H. L., Branch Mgr., Buffalo Forge Co., Pittsburgh, Pa. *(Reinstatement)*

SOPER, H. A., Vice Pres., American Foundry & Furnace Co., Bloomington, Ill. *(Reinstatement)*

VIDALE, RICHARD, Air Cond. Engr., Hamlin Air Cond. Co., Buffalo, N. Y.

WALKER, W. K., Development Engr., American Radiator Co., New York, N. Y.

WHITMER, R. P., Secy., American Foundry & Furnace Co., Bloomington, Ill.

ASSOCIATES

ANTHES, L. L., Pres., Imperial Iron Corp., Ltd., Toronto, Ont., Can.

DALY, C. P., Contractor, Rantman Plbg. & Htg. Co., Seattle, Wash.

DODGE, HARRY G., Vice-Pres., Metropolitan Pipe & Supply Co., Cambridge, Mass.

GEMMILL, R. A., Mgr. Air Cond. & Oil Burner Dept., Schuck Elec. Co., Philadelphia, Pa.

GREEN, A. W., Draftsman, Jackson Heights, L. I., N. Y.

JEFFREY, T. G., Mgr., Bastian Morley Ltd., Toronto, Ont., Can.

SMITH, W. D., Mgr., The Bryant Heater Co., Cleveland, O.

JUNIORS

BURKHART, E. M., Journeyman, Frishkarn Htg. Co., Harmony, Pa.

CRAWFORD, J. H., JR., Orange, N. J. *(Reinstatement)*

JONES, A. T., Mech. Engr., S. A. Armstrong, Ltd., Toronto, Ont., Can.

LINGO, C. K. W., Air Cond. Engr., Florida Power & Light Co., Miami, Fla.

VAUGHAN, J. G., JR., Junior Salesman, American Radiator Co., Washington, D. C.

STUDENTS

ANDERSON, L. B., Student, University of Ill., Urbana, Ill.

BOWDITCH, R. P., Student, University of Ill., Urbana, Ill.

BROWN, N. A., Student, University of Ill., Urbana, Ill.

FAULKNER, GORDON, Student, University of Ill., Urbana. Ill.

FICNERSKI, PAUL, Student, University of Ill., Urbana, Ill.,

FITZGERALD, J. F., Student, University of Ill., Urbana, Ill.

FLEMING, T. F., Student, University of Ill., Urbana, Ill.

GALLAGHER, PAUL, Student, University of Ill., Urbana, Ill.

HINTZ, H. P., Student, University of Ill., Urbana, Ill.

JOHNSON, W. A., Student, University of Ill., Urbana, Ill.

LOGAN, T. M., Student, University of Ill., Urbana, Ill.

PIWINSKI, E. J., Student, University of Ill., Urbana, Ill.

RANSOM, C. F., Student, University of Ill., Urbana, Ill.

SEELY, I. R., Student, University of Ill., Urbana, Ill.

STRAKSON, W. C., Student, University of Ill., Urbana, Ill.

THETFORD, J. E., Student, University of Ill., Urbana, Ill.

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WHEN the weather talks, Weatherstat answers – answers by instantly governing the heat supply so that outside variations in temperature are compensated and balanced before their effects are noticeable inside ... The Weatherstat is only one of the complete line of Minneapolis-Honeywell Modutrol System controls. There is a control system for every purpose and for every type of heating or air conditioning system, so the Modutrol System can adapt itself to any equipment, rather than necessitating the adaptation of such equipment to the controls. Only when a fully flexible and complete control system is used, can control be fully and completely satisfactory. The Minneapolis-Honeywell Engineer in or near your city is available for consultation . . . Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave. S., Minneapolis, Minn.

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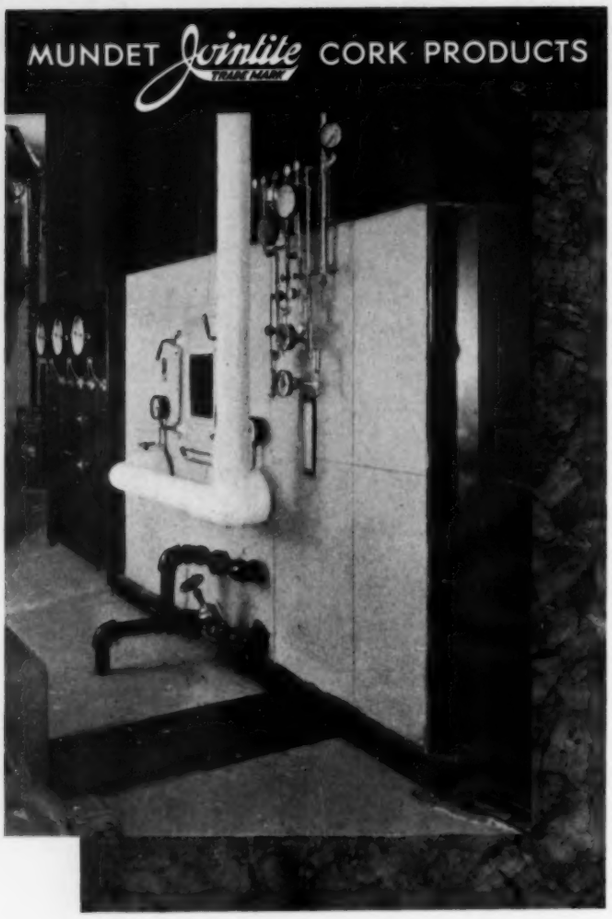
SECTION 26
CATALOG 65

MINNEAPOLIS HONEYWELL

CONTROL SYSTEMS



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was specified for the air conditioning system of the Los Angeles Theatre (shown above). This is one of many Mundet air conditioning installations that have demonstrated the value of Mundet insulation for efficient, economical temperature control.

The same indispensable services that Mundet Cork products have performed for years in cold storage and ice plants are available to the air conditioning industry. The cork comes in thinner sections, of course, since the services are not so severe, but there is the same high quality and low transmission coefficient per inch of thickness that have kept Mundet cork insulation on the job throughout the world.

Mundet Natural Cork Isolation Mats, for machine vibration, solve another problem for the Air Conditioning field.

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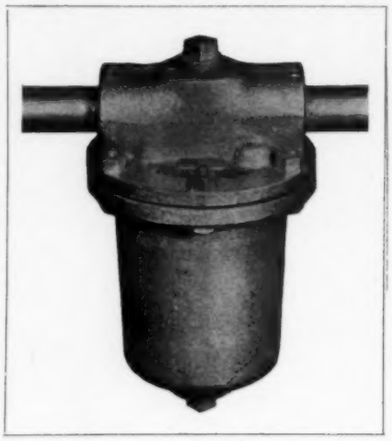
Equipment Developments

For your convenience in obtaining more information about any of this equipment, see coupon on page 103

New Line of Inverted Bucket Traps

No. 171—A new line of inverted bucket steam traps ("Super Silvertop") just announced has been designed to save on pipe fittings, installation time, and maintenance expense. There are five sizes, capacities in lb of water per hr ranging from 200 to 2400 for 1 lb operating pressure, and up to 9600 lb of water per hr for the maximum 250 lb operating pressure.

These traps have two inlet connections at right angles to each other to permit their being used as elbows or straight in line. Other features include accessibility, it being possible to inspect and clean them without disturbing pipe connections; parts alignment, the bucket being guided on a hexagonal tube which makes a knife edge contact to eliminate friction; and the reverse flow feature, whereby the entering condensate is deflected on the bottom of the case and does not impinge on the bucket. Condensate is directed upwardly, spreading over a large area, which permits the trap to remain wide open under heavy load periods, according to the manufacturer.



All passages through which condensate flows are of liberal area and bored smooth, states the maker, and air elimination is automatic. All working parts are of heat-treated stainless steel and valve and seats are of "Anderloy", a chrome alloy.—The V. D. Anderson Co., 1949 W. 96th St., Cleveland, O.

Welding Ells of Stainless "Clad" Steel

No. 172—The stainless "clad" steel welding ell illustrated is formed from a ply plate having a thin surface of true stainless steel (18-8) on a foundation of mild steel. The stainless steel may be either the lining of the fitting to protect the mild steel covering from the action of corrosive or erosive fluids, or the outer covering to protect the inner mild steel from external corrosive conditions. Stainless steel welding rod is used for the longitudinal weld of the stainless surface, and high tensile rod for the carbon steel.

These stainless "clad" steel welding ells have the features of the regular low carbon steel fittings made by the same company, including long tangents (¼ in. per in. of diameter) to

Showing Fedders coils equipped with Fedders Model 33-HC Thermostatic Expansion Valves.

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To simplify the engineering and installation of air conditioning systems, Fedders announces a complete line of standard catalog sizes of all-copper cooling and dehumidifying coils in CAPACITIES FROM 1 to 100 HP.

FEDDERS BULLETIN 91 clarifies and simplifies many engineering questions about air conditioning coil selection. It is a working handbook that every engineer can use.

It gives coil sizes, capacities, conversion tables and charts —all in workable form. Coils are classified by model numbers for easy identification and quick selection. WRITE FOR YOUR COPY.

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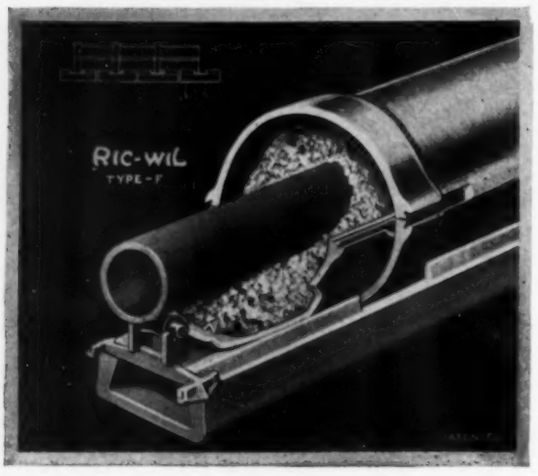
The prevention of such waste (common the country over) is the business of Ric-wiL. Steam is money. Let us help you find *buried treasure* in your present underground pipe lines, and prevent it in your future installations.

Ric-wiL offers you the highest known efficiency in the insulation and protection of underground steam lines. Ric-wiL Conduit—made in a variety of types, materials, and insulation (including the famous waterproof asbestos Dry-paC) satisfactorily and economically meets *any* problem of underground steam transmission. Our service is complete in an engineering as well as manufacturing sense—from coast to coast. Details on request.

The Ric-wiL Co., 1562 Union Trust Bldg., Cleveland, Ohio
New York San Francisco Chicago
Agents in principal cities

● Ric-wiL Dry-paC is pure asbestos insulation, which has certified conductivity of only .36 B.t.u. for low pressure.



Registered in U. S. Patent Office

·RIC-WIL·

CONDUIT SYSTEMS FOR UNDERGROUND STEAM PIPES

facilitate erection and save pipe, dimensional accuracy and uniformity resulting from a special sizing operation, final working of metal in compression at forging heat that normalizes both plate and weld, etc.

Stainless "clad" steel pipe is also available.—Midwest Piping and Supply Co., St. Louis, Mo.

New Plug Type Valve

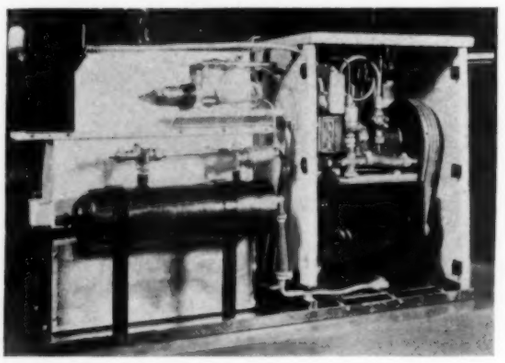
No. 173—This new plug type valve was designed for service where there is excessive wire drawing or destructive action of any kind on the valve seat or disc, such as when used for drip, drain, throttling, etc. The long seating surface between the plug and the seat is designed to insure added life. When these surfaces become scored or cut they can be readily reground or renewed if necessary.

Due to the angle of the plug and seat ring sealing surfaces, the stream flow is uniformly distributed when passing between these components; the force of the stream cannot be concentrated on any part of the plug or seat and produce erosion or wire drawing, says the maker.

The seat ring is screwed into the diaphragm, providing easy renewal. Both seat and disc are made of special nickel alloy of high Brinnel hardness and can be reground indefinitely without removing the valve from the line. A shoulder on spindle affords a back seat which permits packing the stuffing box under pressure when the valve is wide open.—The Fairbanks Co., 396 Lafayette St., New York, N. Y.

½ Ton Air Conditioner

No. 174—A self contained air conditioning unit with a capacity of ½ a ton of refrigeration is illustrated (rear view); low in height, it fits below the windowsill of the average room. Interference with window curtains or drapes is eliminated, as the air is taken in through the front of the unit and is blown out through a grille located in the center of the cabinet top. It can also be



built in under the window itself thus eliminating the containing cabinet.

One of the features of this conditioner is the fact that it is of the "semi-movable" type. Thus the owner is able to move it from place to place.

Motor and compressor are mounted on a separate frame from the one which supports the coils, and the entire unit is mounted on a cork base. Rubber, springs and sound absorption material are used to insure quietness.

Switches on top of the cabinet control operation winter and summer. In the event that a thermostatic control is used, the machine operates automatically. It is only necessary to lubricate motors and make minor adjustments twice a year.

The cabinet is 46½ in. long, 15⅜ in. wide, and 26 in. high and contains motor, compressor, cooling coils and fan. Cabinets come

OUR CONTRIBUTION TO THE DURABLE GOODS RECONSTRUCTION PROGRAM

TRADE MARK
YOUNGSTOWN

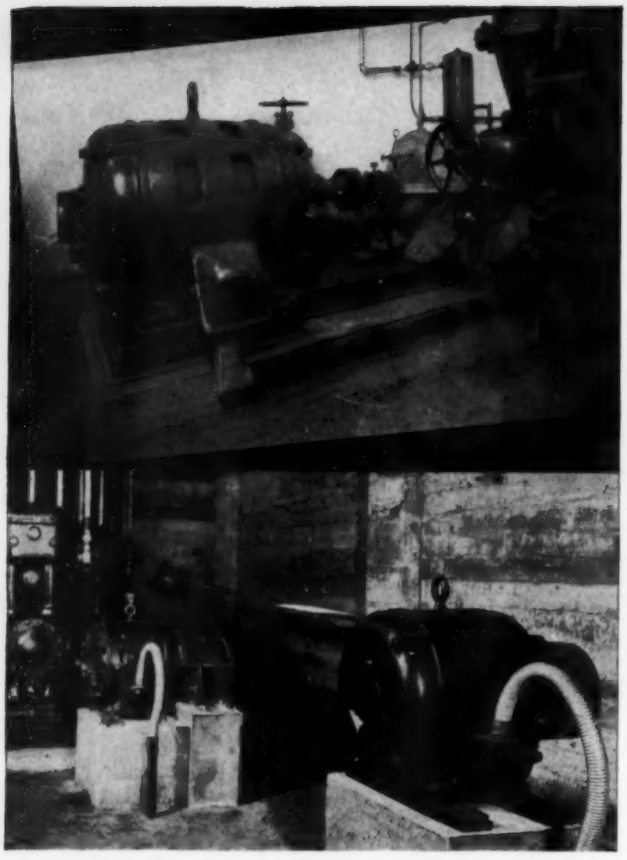
Early this year we will put into operation a new wide continuous hot mill, for the production of sheets, strips and plates, up to 72 inches wide, and very soon thereafter a wide cold rolling mill producing flat cold rolled products up to 90 inches wide. This mill, a paramount engineering achievement, is the most recent design of rolling mill equipment, having many distinctive and exclusive features.

Announcement is made of the completion of a new mill for the production of electrically welded pipe, by the direct current resistance weld process. We can now furnish electrically welded pipe from 6⅝ inches up to and including 26 inches, outside diameter.

★

The never-interrupted program at Youngstown is the promotion of engineering and metallurgical research. This program is aimed not alone to meet industry's exacting needs, but to anticipate and be prepared for tomorrow's requirements as well.

THE YOUNGSTOWN SHEET AND TUBE COMPANY
Manufacturers of Carbon and Alloy Steels
General Offices - - - YOUNGSTOWN, OHIO



TOP—*125 H. P. Century 3-Phase, 2200 Volt, 60 Cycle Motor Direct Connected to Centrifugal Pump.*

BOTTOM—*75 H. P. and 25 H. P. Century 3-Phase, 220 Volt, 60 Cycle Motors, Belt Connected to Ammonia Compressor in Cold Storage Plant.*

BIG MOTORS *for* BIG JOBS

The illustrations on this page are typical of the many heavy-duty installations where Century Motors are steadily doing a big job — constantly meeting the severe shocks, strains, and stresses imposed by belt, chain, gear or direct drives . . . Sizes up to 600 H.P. . . . Consult Century Engineers — Investigate Century Big Motors for Big Jobs — "They Keep a-Running."

Splash Proof • Multispeed • Slip Ring • Direct Current

CENTURY ELECTRIC COMPANY
1806 Pine Street , , , St. Louis, Mo.
Offices and Stock Points in Principal Cities

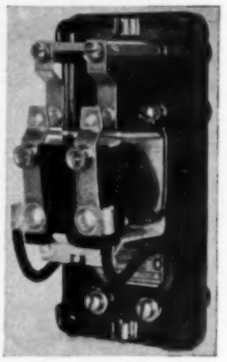
Century

SINGLE PHASE, POLY-PHASE, DIRECT CURRENT
1/250 to 600 H. P.
MOTORS

in a number of standard finishes or may be specially finished at slight extra cost. Airtemp Corp., Chrysler Bldg., New York, N. Y.

Small Auxiliary Relay

No. 175—A small, sturdy, low-priced auxiliary relay for use on a-c. or d-c and suitable for switchboard or panel mounting has been announced; the type for switchboard mounting has a molded cover or molded cover with glass front; the front connected panel mounted relay uses no cover. Both have two independent contact circuits which may be easily adjusted for circuit-closing or circuit-opening service. For two independent opening circuits, additional material must be added to the standard relay.



Designed for continuous duty at rated voltage, the relay is obtainable for circuits up to 550 volts a-c or 440 d-c. Ranges up to 250 volts can be used for intermittent duty up to approximately three times their continuous value. The relay can be supplied with a coil for any current value up to 5 amperes. Each contact will carry 12 amperes continuous and 20 amperes for one minute.—Westinghouse Electric and Mfg. Co., East Pittsburgh, Pa.

Air Eliminator for Steam Heating Systems

No. 176—A new air eliminator developed to quickly vent steam mains in apartment and other large buildings is 4 in. in diameter, 7 in. high with ½ in. vertical connection and its air outlet is four times greater than that of this company's other air eliminator. The operating member is made of a special non-corrosive thermo-metal sensitive to heat changes and positive in operation.

When steam or vapor enters the eliminator the heat causes the thermo-metal to expand, close the eliminator, and hold it closed as long as there is any steam in the main. The eliminator also has an open float which will close it against a slug of water; the large space between the float and the eliminator body insures positive drainage and prevents water-logging, states the maker.

It can be used on one or two pipe steam or vapor heating systems.—Gorton Heating Corp., Cranford, N. J.

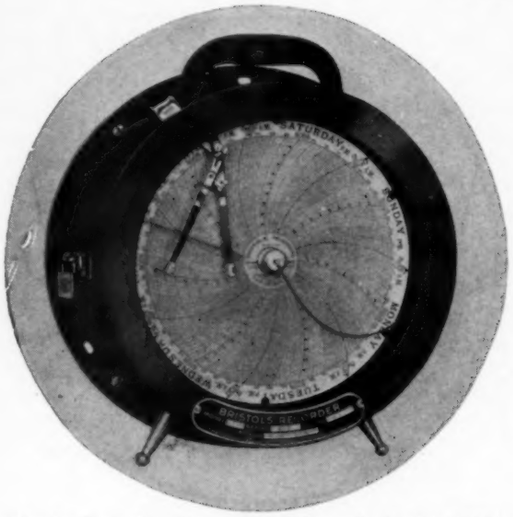
New Air Nozzles

No. 177—Two new designs of bronze air nozzles, with renewable, non-metallic discs, have been placed on the market. One is made with integral hose end, and the other with female pipe end. Either pattern can be furnished with pointed, flat, or

extension tip. These nozzles find application for blowing dust, dirt, chips, filings, borings, sand, lint, liquid deposits and other matter, prevent air waste.

The disc is especially compounded for air service, and easy

Should be used wherever *definite atmosphere conditions* are being maintained



Bristol's Portable Thermo-Humidigraph, Model 4069. Eight inch chart. Specify Model 4068 for surface mounting in permanent location. Charts for 24 hour or 7 day records. Model 4044 four inch Humidigraph, without pen arm for recording temperature, also available.

By providing a continuous record both of temperature and relative humidity, Bristol's Thermo-Humidigraph makes it possible to check continually the atmospheric conditions under which a product is being made.

As one manufacturer puts it, "Bristol's Thermo-Humidigraph should be used as a check in all localities where a definite atmospheric condition is being maintained. We find this instrument very rugged and reliable, and use it to record conditions in various departments."

Write for Bulletin 4132.

THE BRISTOL COMPANY, WATERBURY, CONNECTICUT

Branch Offices: Akron, Birmingham, Boston, Chicago, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, St. Louis, San Francisco

TRADE MARK

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PIONEERS IN PROCESS CONTROL SINCE 1889

BUSH INDIVIDUAL FIN COILS

THIRTY-TWO COMBINATIONS OF FIN AND TUBE SIZES AND FIN SPACING CAN BE FABRICATED INTO COILS ANY NUMBER OF TUBES HIGH OR WIDE AND IN LENGTHS TO TWELVE FEET

FOR AIR CONDITIONING

COMPLETE FLEXIBILITY MAKES AVAILABLE THE PROPER COMBINATION OF FIN AND TUBE SURFACE TO INSURE EFFICIENT AND ECONOMICAL OPERATION

ALL REFRIGERATION NEEDS

INDIVIDUAL FIN CONSTRUCTION MAKES IT POSSIBLE TO MAKE PROMPT SHIPMENT OF COILS TO YOUR SPECIFICATIONS. THIS MEANS BETTER INSTALLATIONS AND GREATER PROFITS.

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BYERS
WROUGHT IRON

for Pipe and Elbows
Gives longer life
in Corrosive Service

● Today, leading engineers are specifying Byers Wrought Iron for corrosive lines where pipe failures and replacements come too soon. And to back up these specifications they refer to wrought iron's long faithful record covering 30, 40 and 50 years in corrosive service.

For your all-welded piping systems be sure you specify Byers Genuine Wrought Iron Pipe and welding fittings made for Byers Genuine Wrought Iron Pipe. For further information, suggested specifications and service records to back up your recommendations ask a Byers Field Engineer or write our Engineering Service Department.

BYERS GENUINE WROUGHT IRON PRODUCTS

A. M. BYERS COMPANY
Pittsburgh, Pa. · Established 1864

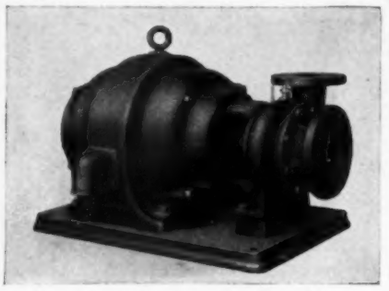
renewability insures seat tightness. To renew a disc, the nut at bottom of nozzle is unscrewed and the spring and old disc is renewed, and a new disc inserted.

Unrestricted flow area permits free passage through the nozzle of scale and grit that might be carried with the air from the pipe line. Provision is made for hanging the air nozzle on a nail or small hook when not in use.—The Lunkenheimer Co., Cincinnati, O.

Two Larger Pump Sizes

No. 178—Two larger units have been added to the "Monobloc" centrifugal pump group, for air conditioning, water heater, refrigeration, boiler return system, brewery, laundry, chemical process, industrial plant, and such applications. The new pumps (sizes 3" and 4") are essentially similar in design to the original smaller (1" to 2½") units of the line, and considerably extend the range and capacities of the group.

This pump, besides being rigidly mounted on the motor frame, is supported by a foot resting on the base. The pump im-

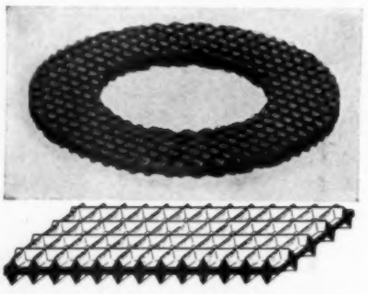


peller is mounted directly on the motor shaft and both pump and motor are bolted to one rigid base, relieving the pump from possible pipe strain. Additional improvements are in impeller design, renewable wearing rings, and balance rings that eliminate end-thrust and put the stuffing box under suction pressure only to increase the efficiency and active life of the unit.

These pumps can be furnished in standard bronze, all bronze, or all iron. Electric characteristics may be any standard or any specials. Motor construction may be standard (splash-proof) or special (explosion-resisting, etc.). Mounting can be either horizontal or vertical.—Worthington Pump and Machinery Corp., Worthington Ave., Harrison, N. J.

New Metallic or Semi-metallic Gasket

No. 179—A new multiseal gasket to withstand extreme pressure, temperature change and vibration, is designed to produce perfect tightness with only 30 per cent as much contact surface



as on a plain flat metal gasket, and consequently with greatly reduced bolt pressure, according to the manufacturer. This is accomplished by providing the faces with crossed ductile and resilient raised ribs, which under very small bolt pressure, are said to set themselves into tight contact even on imperfect flange faces.

These gaskets are available as solid copper, steel, "Armco" iron, aluminum or lead, or as a metal shell with asbestos filler,

and in any circular, elliptical or special shape.—Goetze Gasket & Packing Co., New Brunswick, N. J.

Tap Chaser Rake Grinding Attachment

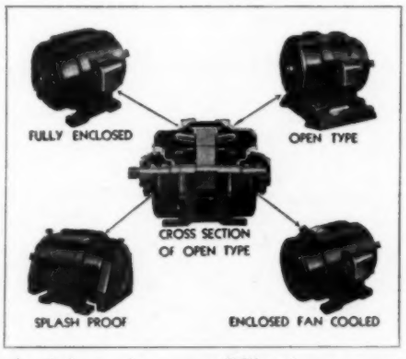
No. 180—The attachment illustrated (for use in regrinding or sharpening chasers used in receding chaser collapsible taps) is composed of three main parts; first, a base which is adapted for fastening to the table of most makes of tool and cutter grinding machines. Attached to the base is a second part, the swivel bracket, which is adjustable in a horizontal plane in relation to the base. The bottom part of the swivel bracket is graduated to permit obtaining the desired degree of azimuth, which is the angle at which the chaser is set from the parallel. The third part of the attachment is the vise base which is clamped to the swivel bracket and which holds the chaser while being ground. The vise base can be rotated in the vertical plane and securely clamped at any angle as determined by graduations on the top of the swivel bracket. This permits setting the chaser at the proper elevation for grinding the gun tap in the throat section of the rake.

The vise base is provided with a milled flat which will accommodate all sizes of tap chasers. The chaser is held in place by an adjustable spring clamp and locked with a hand screw.

The attachment is suitable for grinding all sizes of chasers employed in this company's "Style LT" collapsible taps, the "Style LM" receding chaser collapsible taps and also those employed in the "Victor" collapsible and receding chaser taps.—The Landis Machine Co., Tap Division, Waynesboro, Pa.

New Line of Convertible Motors

No. 181—An entirely new line of convertible squirrel cage and slip ring induction motors, offering all standard frequencies for service ranging from 110 to 220 volts, just announced is built in accordance with the standards adopted by the National Electrical Manufacturers' Association. Outstanding feature of



the motors is their ready convertibility from open type to fan cooled, splash proof or totally enclosed construction, accomplished through the design of the frame, end heads and bearings to permit interchangeability in the four above mentioned types of single or multi-speed squirrel cage and slip ring motors.

Among other features is the unique mounting of the stator laminations which are stacked between heavy steel end rings and the entire assembly then welded to the frame, this construction providing rigidity and making it impossible for the stator core to shake loose, according to the manufacturer. The

TAYLOR FORGE WELDELLS

of Byers Wrought Iron

Correctly Engineered for better Installations

● For your all-welded wrought iron lines be sure you get the many advantages offered in Taylor Forge Weldells . . . remember there is no price premium.

Full pipe thickness, plus selective reinforcing at the crotch . . . smooth interior and exterior with accurate dimensions . . . tangents for accurate alignment . . . ends machine-tool beveled for clean, even-welding—these are the outstanding features of Taylor Forge Wrought Iron Weldells made in a complete range of sizes from Byers Wrought Iron Pipe by our own patented forging and forming process. Write for complete information and estimating prices.

TAYLOR FORGE

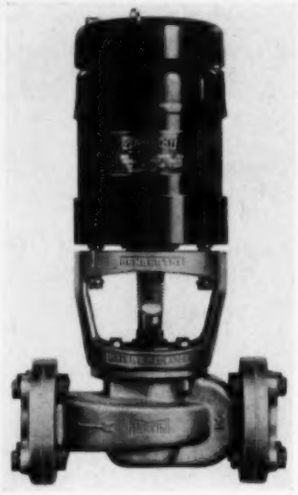
FITTINGS FOR WELDING

TAYLOR FORGE & PIPE WORKS
General Offices and Works, Chicago, Ill., P. O. Box 485
New York Office, 50 Church Street

rotor windings are assembled from round or rectangular hard drawn copper bars which are placed in the rotor slots without insulation or slot wedges. The ends of the bars are brazed to the end rings by an electric arc torch.—The Harnischfeger Corp., West National Ave., Milwaukee, Wis.

Circulator for Hot Water Heating Systems

No. 182—The water circulator illustrated, which is a centrifugal type pump constructed of high grade steam bronze, is available in three sizes rated at 1250, 2500, and 6000 sq ft of radiation. It was developed for the modernization of gravity hot water heating systems, and for application to new forced circulation hot water systems. It forces the heated water from the boiler throughout the system to eliminate delay in heat delivery; according to the manufacturer, the faster flow of water over the boiler heating surface increases rate of heat transfer and efficiency and the faster flow through the piping reduces transmission losses. Other advantages include overcoming of inadequate pipe sizes, circulation of water to radiators below boiler room level and to remote radiation on long horizontal runs, and—on new jobs—the possibility of using smaller pipe sizes.



The motors (⅙ hp for the two smaller sizes and ¼ hp for the largest size) are condenser start—condenser run, single phase, 110 volt, 60 cycle, 1725 rpm. Moving parts are insulated from body by sound insulating gaskets. The body has large water passages to permit gravity flow when the unit is not operating. Packing is self adjusting, and prevents bearing lubrication from entering the system, states the maker. The impeller shaft is of "Monel" metal, is guided in a lubricated bronze bearing outside the packing.—Penberthy Injector Co., Detroit, Mich.

Meter Combines Feed Water Flow, Boiler Water Level

No. 183—A meter to indicate and record both boiler water level and feed water flow consists of a standard fluid meter which indicates, records and integrates feed water flow and a 12 in. indicator with a dial type scale for boiler water level. The indicator is mounted directly above the recording meter on a small feed water panel. If desired, this combination meter can be located on the individual boiler control panel.

For purposes of comparison, it is valuable to have the records of feed water flow and boiler water level recorded on the same chart where they are coordinated as to time and can be interpreted without reference to additional records or calculations.—Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland, O.

Low Water Cut-off and Duplex Switch

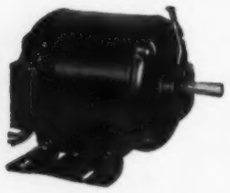
No. 184—A new low water cut-off and duplex switch for steam and vapor heating systems is designed for installation in accordance with the boiler code in the boiler gage glass openings. With these controls in use the circuit to burner control opens when boiler water level lowers to danger point, and closes when normal boiler water level is restored, the circuit to the burner control is automatically reestablished and the alarm circuit is opened. May be readily changed to the manual reset type of control when

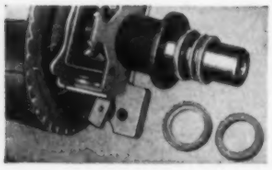
Wagner Motors are Quiet

One of today's biggest industries, electric refrigeration, had a start similar to the air-conditioning industry. In the beginning its sole concern was one of producing automatic operation, with little regard to refinements in mechanical performance. Later the question of *quiet* operation became a competitive point.

Similarly, your industry's primary problem is one of producing automatic heat, and now that that has been accomplished, the buying public is becoming conscious of the noise factor. It was inevitable that quiet operation would be demanded, and it IS being expected of the modern equipment.

Wagner has anticipated this demand, and has developed a complete line of quiet air-conditioner motors.





Among the distinctive features contributing to the quietness of Wagner motors is the rubber mounting, made up of layers of rubber and steel vulcanized together—elastic enough to absorb the small amount of vibration remaining even in the most carefully-designed motor, yet firm enough to preserve correct shaft alignment. The upper photo illustrates this type of mounting, a mounting that does not interfere with the removal of the motor or its endplates.

Another feature is the cork thrust-washer (see lower photo) which eliminates end-play noise. In addition, rotors are skewed to reduce magnetic noise, and dynamically balanced to eliminate vibration; and governor weights are silenced with felt bumpers.

Quiet operation is but one of several motor qualities the air-conditioner manufacturer must consider. There are also such considerations as dependability, interchangeability, appearance, and performance—all of which are fully provided for in Wagner design and construction. For a full description of Wagner motors, ask for Bulletin 167.

There's a Wagner motor to fit your needs, regardless of the type you prefer. Included in the Wagner line of motors are

Type RB	Split Phase
Type KA	Repulsion-Start-Induction
Type RBZ	Capacitor-Start Induction-Run
Type RZH	Capacitor-Start Capacitor-Run
Type RD	Direct-Current
Type RP	Polyphase Squirrel-Cage

Wagner Motors are available in such various mechanical variations as open, totally-enclosed, or drip-proof; rigid or resilient mounted; horizontal, vertical, or flange-mounted; sleeve or ball bearing, etc.

5835-2B

MOTORS TRANS-FORMERS

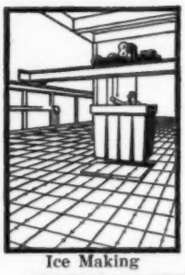
Wagner Electric Corporation
6400 Plymouth Avenue, Saint Louis, U.S.A.

FANS BRAKES

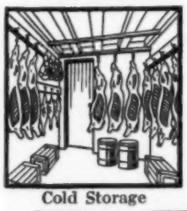
Are You Getting the Full Benefits of Modern Refrigeration?

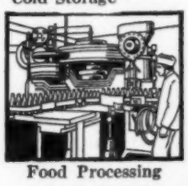
Architectural Work

Retailing


Ice Making

Test and Research


Cold Storage


Food Processing

Quick-Freezing

Transportation

Time was when "ice machines" were used only for brewery work, ice making, and cold storage. Today, Refrigeration will serve your clients in a dozen profitable ways, performing any of the following jobs:

Air conditioning
Cooling drinking water
Test and research work
Processing foods, chemicals, etc.
Cooling boxes and display cases
Serving soda fountains and bars
Precooling fruits before shipment
Making block ice, ice cubes, ice chips or dry ice
Keeping furs, flowers, candy, serums, etc.
Freezing ice cream and other desserts
Transporting under refrigeration
Sinking shafts in quick-sand
Quick-freezing fish, poultry, etc.
Drying motors, cable wire, powder, etc.

Let the nearest Frick man aid you in adapting Refrigeration, the New Tool of Industry and Business, to your particular problems. No obligation; but write, wire or phone NOW.

Frick Company
WAYNESBORO, PA. U.S.A.
ICE MACHINERY SUPERIOR SINCE 1882

No More Air Binding or Spoiled Goods

in Progressive Silk Finishing Co.'s Plant

In the above plant, at Hoboken, N. J., 2,000 lb. pressure hydraulic presses are used to accentuate and "fix" the watered effect in silk. The multiple platens of these presses are hollow and steam heated internally. Difficulty was experienced in some of the platens becoming air bound, resulting in unequal heating and ruined goods.

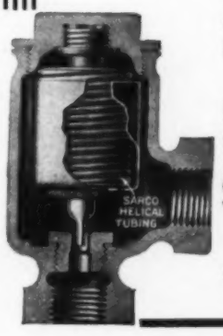
By installing Sarco Steam Traps on the supply lines and drains of the steam heated platens the difficulty was overcome. If you are having trouble with air binding or uneven heating why not consult us regarding

SARCO STEAM TRAPS

Separately trapped with a Sarco, no coil can be water logged by back pressure in the return lines from a neighboring unit. Individual trapping eliminates long connecting lines to traps which waste heat by radiation and over-heat the workrooms.

A separate trap at every point where condensate forms means nothing but cool condensate in the return lines, nothing but hot steam in the machines.

Sarco Traps go into the pipe line like a fitting. Write for Catalog O-95.



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SARCO CANADA LIMITED,
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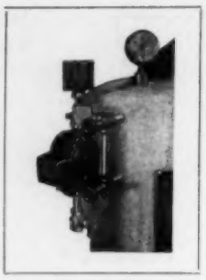
required. The device is equipped with a double circuit mercury switch providing for the operation of an alarm or signal system in addition to its normal function.

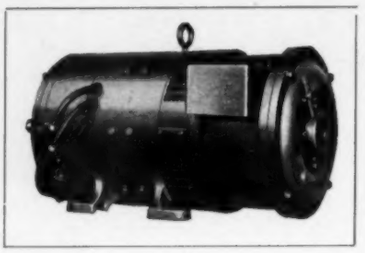


On many types of installations, such as in greenhouses, garages, storerooms and small industrial buildings, an alarm or signal system will warn the attendant when the boiler water level has lowered to the danger point and also simultaneously shut down the burner. The alarm circuit closes when the water level lowers to approximately the same level as indicated by "low water cut-off line" cast into back of float chamber and on sides of the cover casting, which provides for an ample margin of safety and guards against a freeze-up, the firing of a dry boiler, or other damage. When the correct boiler water level is restored, the alarm or signal system is turned off and the burner is again permitted to function normally.—Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., S., Minneapolis, Minn.

Motor for Railway Air Conditioning

No. 185—A new dual motor arranged to meet the requirements for a compact compressor drive to furnish mechanical refrigeration for railway passenger car air conditioning is two independent motors in one frame. It operates from the direct current car circuit when the train is on the road and from alternating current central station power when the car is at the terminal.

The d-c motor has characteristics suitable for operating on the coach circuit and has low starting current to keep down the battery drain. It operates satisfactorily over a considerable voltage range that is ordinarily encountered in railway service. The a-c end is a standard three phase motor to be plugged into connections at the terminal. No switching is necessary to change the operation from road to terminal except to plug in the connection when



the car reaches the terminal as the equipment operates entirely automatically.

This dual motor has been designed for railway service which requires light weight, compactness, and ruggedness.

These motors are available in 5 to 15 hp sizes—Century Electric Co., 1806 Pine St., St. Louis, Mo.

Plug for Repairing Holes and Cracks

No. 186—A plug or rivet for making permanent repairs of large or small holes in liquid, air or vacuum containers has been developed and is illustrated here. It is made of a strong, ductile metal which expands as the hex nut is drawn down and a ferrule on the tip of the plug fans out, compressing a metal head on the inside of the container being repaired. By this means, the plug forms a seal in three ways, and repairs made will hold up to 2000 lb pressure and 900F, according to the manufacturer.

These plugs come in three diameters—¼, ⅜ and ½ in. They are recommended by the maker for a variety of uses, among

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The real dependability and efficiency of Baker Air Conditioning is appreciated by even the most critical of club members. No other class of installation requires such perfection of detail, yet Baker equipment is found in many of the finest clubs the country over. Get the complete story of Baker's long experience in air conditioning . . . . write for descriptive folder and specifications today!

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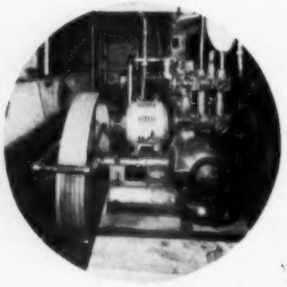
Central Sales: Chicago Eastern Sales: New York



Baker equipment in compressor room of the Tulsa Club, Tulsa, Oklahoma.

Main dining room of the Tulsa Club . . . Baker Air Conditioned.

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Do you merely order so much steel pipe—or do you give serious consideration to the steel pipe you use and order the brand that is best suited to your requirements and that gives you more for your dollar?

Steel pipe is not all alike—there is a vast difference—particularly in the smaller sizes.

Take Fretz-Moon Pipe, for instance. It is made by an exclusive process that is unlike any other method of pipe manufacture. And because it is made of specially-selected materials by this process, it possesses many advantages not found in ordinary steel pipe.

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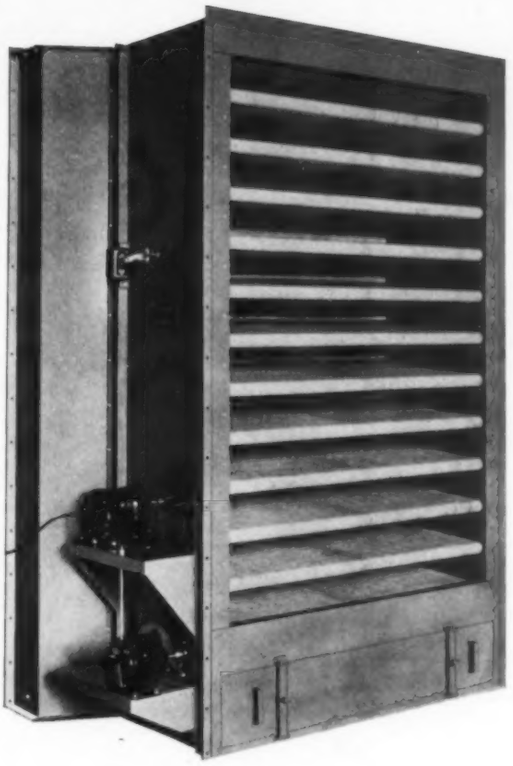

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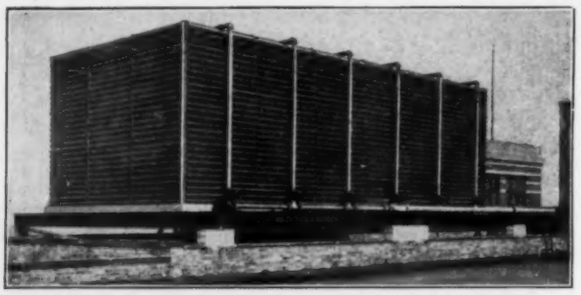

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We offer a standardized complete SHOP CONSTRUCTED TOWER (with full spray nozzle distribution) for most every application. This is evidenced by the more than 3,000 Binks Cooling Towers now in operation.

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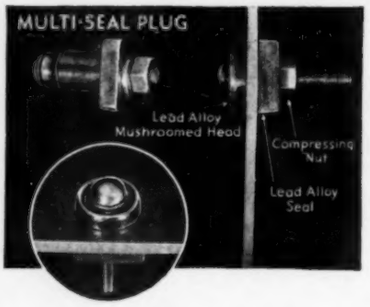
which are the repairing of large or small holes in heating sections, water tanks, gas tanks, air compressor tanks, pipes, sheet metal construction, etc.; for replacing leaky rivets, by sawing or knocking off the head of the old rivet and reaming a hole to fit the plug; plugging pipe ends where it is difficult to thread a



nipple for a cap or tap a connection for a plug; repairing holes or cracks on over-lapping seams; securing large patches on oil reservoirs and other such containers.

They may also be utilized as anchor bolts for securing cabinets, machinery or other apparatus to stone, cement, brick, etc.—Multi-Seal Mfg. Co., P. O. Box 3900, Chicago, Ill.

Add the new products and new companies listed in "Equipment Developments" to your Directory Section (which you received in your January 1935 HEATING, PIPING and AIR CONDITIONING) and thus keep your records of sources of supply up-to-date throughout the year.

Book Reviews

Heating and Air Conditioning Pocket Manual

"Heating and Air Conditioning Manual," by L. A. Harding, Buffalo, N. Y., published by the author. 268 pp., 3 x 5½ in., flexible binding, $1.50.

A wealth of practical data in usable form has been packed into this handy pocket-size manual prepared for engineers engaged in heating, ventilating, and air conditioning. The information it contains has largely been extracted from "Heating, Ventilating and Air Conditioning" by L. A. Harding and A. C. Willard; "Steam Power Plant Engineering," by Harding; and the "Guide" of the *American Society of Heating and Ventilating Engineers.* The manual is not, of course, a text on the subject but rather a compilation of data in readily available and "portable" form.

Numerous helpful tables, formulas, curves and diagrams are included and methods of solving heating and air conditioning problems are outlined, including both central and unit type systems. Practical applications of air conditioning to industrial processes, theater cooling, restaurants, etc., are not neglected.

A rather complete index adds to the utility of the manual.

Manual for Engineers

"Manual for Engineers" (27th edition) published by University of Tennessee, Knoxville, Tenn.; compiled by members of college of engineering. 140 pp., 2¾ by 5¾ in. 75c at the U. of T. book store.

This pocket size manual comprises tables of general interest to engineers and business men. Tabular data on mathematics, mechanical engineering, civil engineering, electrical engineering, etc., are included.

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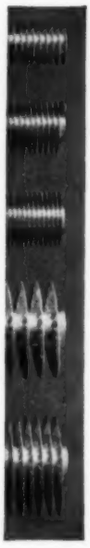
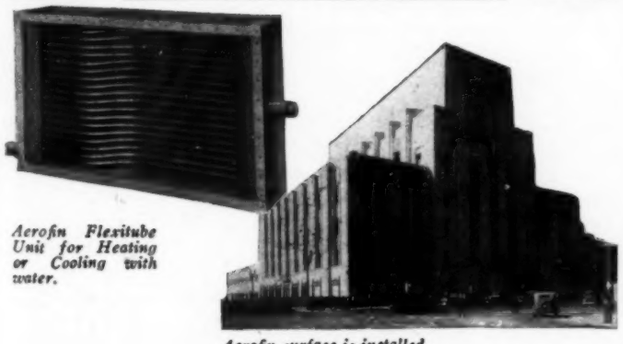
The home office in Newark or any of our branch offices will gladly send complete descriptive literature or render prompt, personal and efficient technical cooperation. Simply write to the address below.





Aerofin Flexitube Unit for Heating or Cooling with water.

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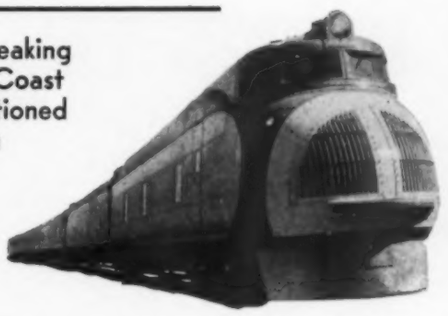
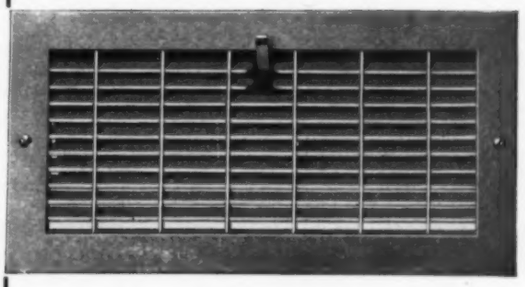


Two Recent Epochal ACHIEVEMENTS



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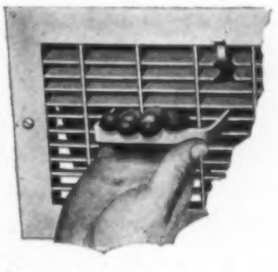
GREAT things are happening these days. Out-of-doors, transportation has entered a new era. Indoors, air conditioning is approaching near perfection.

A development in air conditioning promising far reaching results is the ability to direct air flows with accuracy and certainty never before attainable, made possible by the Independent "Fabrikated" Adjustable Directed Air Flow Registers and Grilles.

These new adjustable registers and grilles are accomplishing amazing things in correcting many previously difficult ventilating and heating situations. They are a necessity in any installation if the best results are to be obtained.



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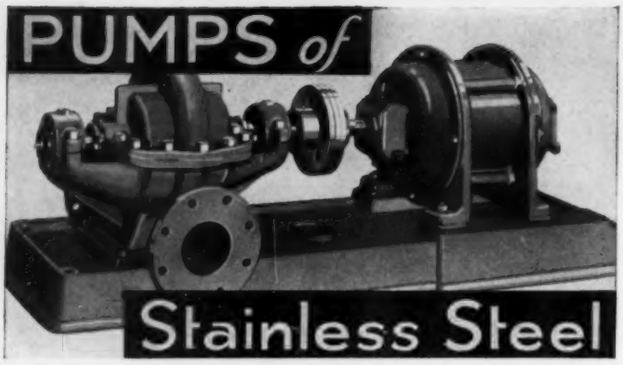

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Here is an absolutely dependable source of supply. **American-Marsh Stainless Steel Pumps are designed right—built right.**

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Available for quick shipment in all capacities up to 40,000 G. P. M. Constructed of California Redwood, Tidewater Red Cypress, Copper Steel and other suitable materials.

Specify Type "E" Schubert-Christy Cooling Towers for air conditioning service. They are expressly designed for such service and are guaranteed to obtain the cold water temperatures necessary for the proper operation of the air conditioning equipment.

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Booklets, Reports and Papers

Use of Globe Thermometer in Heating, Ventilation Studies

"The Globe Thermometer in Studies of Heating and Ventilation," by T. Bedford and C. G. Warner, reprinted from The Journal of Hygiene. 16 pp., 7 x 10 in.

In this paper the authors—Investigators to the Industrial Health Research Board—report their studies of the effects of radiation on the globe thermometer, and show equations and alignment charts for the calculation of mean radiation intensity and of equivalent temperature from readings of the globe thermometer, air temperature, and air velocity. The accuracy of these methods has been tested under industrial conditions.

The authors conclude that while globe thermometer readings alone are unreliable as indications of the effects of thermal environment, valuable results can be secured by using the instrument with an ordinary thermometer and a silvered kata-thermometer.

The globe thermometer consists of a hollow 6 in. copper sphere coated with black paint and containing an ordinary thermometer with its bulb at the center of the sphere, is used in the measurement of radiation of heat from surrounding surfaces.

Studies of Underfeed Burning

"Underfeed Combustion, Effect of Preheat, and Distribution of Ash in Fuel Beds," (Bulletin 378) by P. Nicholls, U. S. Bureau of Mines. 76 pp., 6 x 9 in. Available from Superintendent of Public Documents, Washington, D. C. 10c.

The investigation reported is one of a series by the United States Bureau of Mines on the burning of solid fuels to measure reactions in the fuel beds in the burning of the fuel and in the clinkering of its ash. The object of the studies is to ascertain the burning characteristics while eliminating or standardizing the factors of furnace, chimney, and attendance; they have consequently not been concerned with the absorption or utilization of the heat developed by burning of the fuel, but rather with the action of burning.

Research previously reported has been on the "overfeed" type fuel bed—a general designation that includes hand-firing—and the air used for combustion has been at normal temperatures of about 80 F. This report covers studies of the underfeed-type fuel bed—exemplified by underfeed stokers—and of the effect of preheated air on what transpires in both overfeed and underfeed fuel beds. Because preheated air is used more commonly with underfeed stokers it was advisable to combine these two objectives in the same investigation; thus underfeed burning became the major feature.

Conventions and Expositions

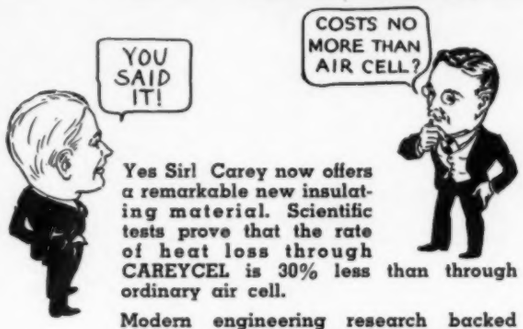
Warm Air Heating Course: March 27-29, Michigan State College, East Lansing, Mich. Under direction of Prof. L. G. Miller, department of mechanical engineering.

Heating, Piping and Air Conditioning Contractors National Association: Annual convention, May 20-22, Hotel Gibson, Cincinnati, Ohio. Acting Secretary, S. Lewis Land, 1250 Sixth Ave., New York City.

American Society of Refrigerating Engineers: Spring convention, May 22-24, Statler Hotel, Detroit, Mich. Secretary, David L. Fiske, 37 W. 39th St., New York City.

Coal Utilization Short Course: June 11-13, College of Engineering, University of Illinois, Urbana, Ill. Under auspices of

Careycel
ASBESTOS INSULATION



Yes Sir! Carey now offers a remarkable new insulating material. Scientific tests prove that the rate of heat loss through CAREYCEL is 30% less than through ordinary air cell.

Modern engineering research backed by more than sixty years of experience in the manufacture of dependable insulating materials produced this vastly improved, low pressure pipe and boiler covering.

Specify Careycel for maximum efficiency and the best looking job at the lowest initial cost. For additional data and specifications, see the Carey Handbook in Sweets Engineering Catalog, or write Dept. A for free sample and full details.

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FAN DUTY MOTORS for UNIT HEATERS AND UNIT COOLERS

ARE THE RESULT OF OVER 50 YEARS EXPERIENCE in building motors for exacting applications.

Holtzer-Cabot Unit Heater motors are equipped with: (1) OVERSIZE BEARINGS having oil return grooves, thus insuring long life with minimum of attention. (2) HAVE SPECIAL RESILIENT THRUST BEARINGS to prevent end play and take up the fan thrust. (3) ARE TOTALLY ENCLOSED.
Available in (1) Split Phase—Single and two speed. (2) Capacitor—Single, two, and three speed. (3) Polyphase—Single and multi-speed. (4) Direct Current.

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AIR COOLING AND CONDITIONING

WITTENMEIER, a name associated with Refrigeration in all its phases and applications for over 35 years, offers complete Air Conditioning and Refrigerating Systems for industrial processes and bodily comfort, either in Central or Unit Systems from ¼ ton capacity up.

Refrigerants: CO_2—Freon—Ammonia—Methyl Chloride—Steam—Water Vapor.

The Carbonic System, pioneered and developed by Wittenmeier, is classified as the safest of all present day methods. Why sacrifice Safety and Reliability for the extravagant claims and doubtful economies advanced for untried and unproven methods? In the face of these extravagant claims, Wittenmeier, during the season just passed, in the Chicago Area alone, installed fifteen theatre cooling jobs and in each instance, a Carbonic (CO_2) Installation was made. The theatres ranged in size from 400 to 2,000 seats.

Whether you are interested in conditioning a single room, office, shop, restaurant, bank, theatre, auditorium or large office building, there is a Wittenmeier System best suited for the purpose.

Let us make a survey of your requirements and give you our unbiased opinion of the system best suited for your needs. There is no obligation. Wittenmeier, with Air Cooling and Conditioning Experience that dates back to 1908, can offer helpful suggestions. Architects, Engineers, Contractors and others should avail themselves of this service.

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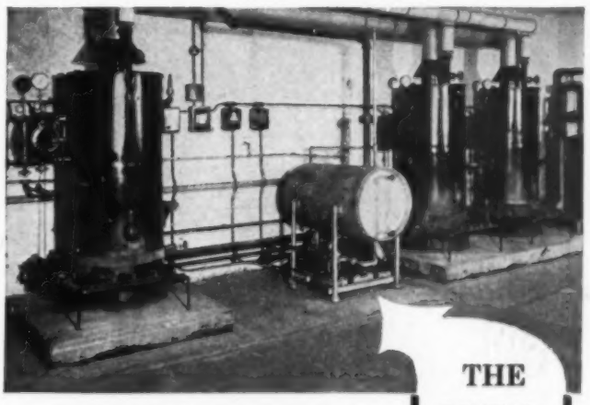

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THIS UNIT AUTOMATICALLY MAINTAINS A CONSTANT WATER LEVEL IN HIGH OR LOW PRESSURE BOILERS

It eliminates all feed water worries, as it automatically pumps feed water against high boiler pressure—returns condensate to boiler—supplies make-up water as needed.

It requires no steam and can be used with gas, oil, stoker or hand-fired boilers.

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The April issue of this magazine will give you full details of a vastly improved design of THERMO VALVES for Methyl and Freon.

EACH VALVE WILL CARRY A TWO YEAR GUARANTEE AGAINST FAILURE OF THE POWER ELEMENT. Science has again come to our aid in solving the one troublesome feature of the THERMO VALVE. The new line of valves will have power elements that cannot lose their charge without mechanical injury to the metal itself. The new power elements WILL BE INTERCHANGEABLE WITH ALL VALVES NOW IN OPERATION.

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If you used unfiltered compressed air to dry motion picture films you could *see* the specks of oil, water, rust, scale and dirt which ruined thousands of dollars worth of films before producers installed Protectomotor Pipe Line Air Filters.

But because these damaging elements cannot be seen through the pipe line, it is hard to realize how much money is wasted when unfiltered compressed air is used for pneumatic tools, paint spraying, cleaning operations, agitating liquids, chemical processes, etc.

Protectomotor Pipe Line Filters remove 999 of every 1,000 particles of foreign matter from compressed air lines. Only clean, dry compressed air can reach the tools and work.

Over 350,000 Protectomotors have been sold for use on compressors, Diesel engines, vacuum pumps, blowers, building ventilation, etc. They come in all sizes.

Write for full particulars about Protectomotor Filters and free trial offer.

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PROTECTOMOTOR
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AIR FILTERS

the departments of mining and metallurgical, and mechanical, engineering.

National District Heating Association: Annual convention, June 11-14, Bellevue-Stratford Hotel, Philadelphia, Pa.

American Society of Mechanical Engineers: Semi-annual meeting, June 19-21, Cincinnati, Ohio. Secretary, C. E. Davies, 29 W. 39th St., New York City.

American Society for Testing Materials: Annual meeting, June 24-28, Book-Cadillac Hotel, Detroit, Mich. Exhibit of testing and related equipment to be held concurrently. Assistant Secretary, R. E. Hess, 260 S. Broad St., Philadelphia, Pa.

American Gas Association: Annual convention, October 14-18, Atlantic City, N. J.

Recent Trade Literature

For your convenience in obtaining copies of bulletins, see coupon on page 103

No. 269. AIR COMPRESSORS: Brunner Mfg. Co., Utica, N. Y. 24 page catalog and price list supplement of single stage and two stage air compressor outfits, air tools, spray painting equipment, air fittings, tanks, hose and belts, electrical control, etc. A helpful technical section on air compressor data is included, is of aid in the application of the equipment described.

No.270. AUTOMATIC CONTROLS: Minneapolis-Honeywell Regulator Co., 2701 Fourth Ave., S., Minneapolis, Minn. Folder describing briefly automatic controls for reducing cost of steam for heating buildings.

No. 271—COOLING TOWERS: Binks Mfg. Co., 3106 Carroll Ave., Chicago, Ill. 8 page bulletin on indoor forced draft spray cooling towers presenting complete information about constructional features, picturing installations, showing typical arrangements, and presenting size and capacity data and specifications. Also an 8 page bulletin devoted to atmospheric spray cooling towers for air conditioning and refrigeration, including engineering information and helpful data.

No. 272. DIESEL ENGINES: Worthington Pump and Machinery Corp., Worthington Ave., Harrison, N. J. 16 page booklet devoted to vertical four-cycle, direct injection diesel engines of four types containing data of general interest as well as specific information about the engines, which range in size from 25 to 1000 hp, 1 to 8 cylinders.

No. 273. DIFFERENTIAL THERMOSTATS: American Schaeffer & Budenberg Div., Consolidated Ashcroft Hancock Co., Inc., Bridgeport, Conn. 12 page planographed bulletin describing differential thermostats for air conditioned railroad cars, these controls being adaptable to air conditioned buildings as well. Instrument automatically controls inside temperature at proper point in relation to outdoor temperature, avoiding excessive cooling, uneconomical operation of compressor, shock on entering or leaving cooled space, etc. One model may be used for control of heating as well as cooling by throwing a hand switch.

No. 274. FEED WATER REGULATORS. Bailey Meter Co., 1050 Ivanhoe Road, Cleveland, O. 16 page bulletin dealing with thermo-hydraulic feed water regulators, illustrating diagrammatically the principle of operation, describing regulating valves of both tight seating and sleeve type construction, including data on excess pressure valves, and tabulating valve dimensions.

No. 275. FITTINGS: Rhode Island Fittings Co., Hillsgrove, R. I. 38 page catalog of malleable iron screwed fittings and unions, malleable iron and grey iron flange unions, cast and

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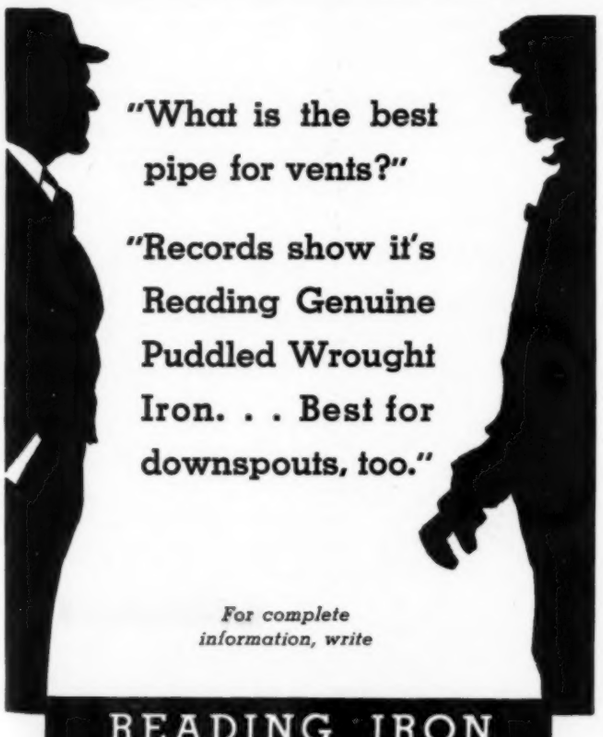

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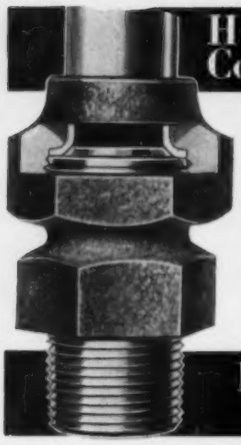

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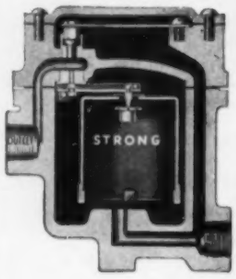

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No. 277. FUEL SAVING: L. J. Wing Mfg. Co., 14th St. and 7th Ave, New York, N. Y 8 page reprint of article on the possibility of reducing fuel costs for heating by installation of forced draft equipment and use of lower priced fuels.

No. 278. HEATERS: Young Radiator Co., Racine, Wis. Data sheet describing portable electric convection heaters for various applications.

No. 279. INDUSTRIAL EQUIPMENT: L. O. Koven & Bro., Inc., 128 Ogden Ave., Jersey City, N. J. Loose-leaf catalog of industrial equipment, including tanks for process and storage, equipment for chemical and allied industries, mixers, equipment for food industries, special industrial equipment, marine equipment, plate and sheet metal work, built up welded construction, containers, cabinets, and racks, sinks and tables, and galvanizing.

No. 280. PACKINGS: Alexander Brothers, 406 N. Third St., Philadelphia, Pa. 24 page booklet on leather packings of various types.

No. 281. PIPE FITTINGS: Malleable Iron Fittings Co., Branford, Conn. 52 page catalog and price lists of malleable iron fittings for gas, steam, oil, and water giving complete information, illustrations, etc.

No. 282. PUMPS: Worthington Pump and Machinery Corp., Harrison, N. J. 4 page bulletin on single stage volute centrifugal pumps.

No. 283. REFRIGERATION: Frick Company, Waynesboro, Pa. 8 page bulletin on marine refrigeration, picturing the uses of this company's equipment on various types of vessels.

No. 284. REFRIGERANTS: R. & H. Chemicals Dept., E. I. duPont de Nemours & Co., Wilmington, Del. 4 page service bulletin containing information on methyl chloride.

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No. 287. STOKERS: Combustion Engineering Co., Inc., 200 Madison Ave., New York, N. Y. 16 page catalog illustrating and describing center retort, underfeed stokers, discussing construction, operation, and control, economics of buying a stoker, applications to various types of boilers, typical ashpit and air duct arrangements, etc.

No. 288. TRANSFORMERS: General Electric Co., Schenectady, N. Y. 8 page bulletin on control and signal transformers, discussing applications and selection in addition to describing the equipment. Also a 20 page booklet devoted to air-cooled transformers for lighting and power service giving complete information about such equipment.

No. 289. UNIT VENTILATORS. John J. Nesbitt, Inc., Holmesburg, Philadelphia, Pa. Loose-leaf engineering data book for "Series 400" unit ventilators manufactured in three types—all outdoor air; variable quantity of outdoor air with a fixed minimum; and a variable quantity of outdoor air without a fixed minimum. The type may be changed at any time merely by changing the cycle of control. A separate section of the data book is devoted to capacities, temperature control methods, and specifications for each type, and a fourth section shows detail drawings applying to all types.

No. 290. VALVES: Everlasting Valve Co., Jersey City, N. J. 8 page bulletin describing various types of valves manufactured by this company.

No. 291. VALVES: The Lunkenheimer Co., Cincinnati, O. 8 page bulletin describing construction and applications of "Causal" metal gate valves for corrosive services, the alloy being an austenitic ferrous alloy containing a high percentage of nickel, some copper, and some chromium. An interesting table shows some of the specific applications of these valves for a variety of process liquids.

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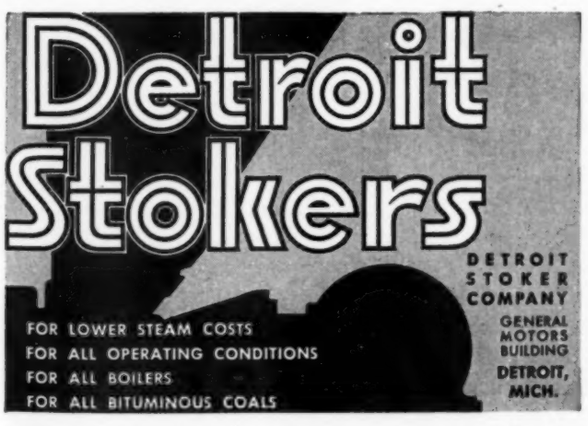

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